. XXXIV. April, 1908 No. 4.

LIBRARY OF CONGRESS JUL 1908 D. of D.

MUNICIPAL ENGINEERING

A MONTHLY MAGAZINE

DEVOTED TO THE IMPROVEMENT OF CITIES

CONCRETE CONSTRUCTION, PAVING, SEWERAGE, WATERWORKS, STREET LIGHTING, PARKS, GARBAGE DISPOSAL, BRIDGES.

PUBLISHED BY
MUNICIPAL·ENGINEERING·COMPANY
INDIANAPOLIS AND NEW YORK.

Registered in United States Patent Office

Two Dollars Per Year. Single Copies, 25 Cents.

THE HAND-BOOK for CEMENT USERS

THIRD EDITION

Is the most practical work on the use of cement yet published. Contains no burdensome theory, but gives facts, demonstrations and examples of work that has been actually performed and proved practical and satisfactory. Informs you how to select the best cement, write specifications for cement, write specifications for the work in which the cement is to go, put the work together, estimate the cost of materials and estimate the quantity of material.

Remember it is a practical work for practical men.

375 Pages, Cloth Bound, Price $3.00

Municipal Engineering Co., 28 S. Meridian St., Indianapolis

THE GAMEWELL FIRE ALARM TELEGRAPH COMPANY

MANUFACTURERS AND CONTRACTORS FOR OVER 50 YEARS OF

Fire Alarm and Police Signal Telegraphs

AND FOR SPECIAL APPARATUS THEREFOR.

OVER 1,300 Plants in actual service in the United States and Canada. Plants also established in Cuba, Philippine Islands, South America, Germany, Hawaii, West Indies, England, Norway and South Africa.

JOSEPH W. STOVER, President C. W. CORNELL, Secretary W. W. BOWES, Treasurer
WILLIAM GELLATLY, Gen. Supt.

EXECUTIVE OFFICE 19 BARCLAY STREET, NEW YORK CITY

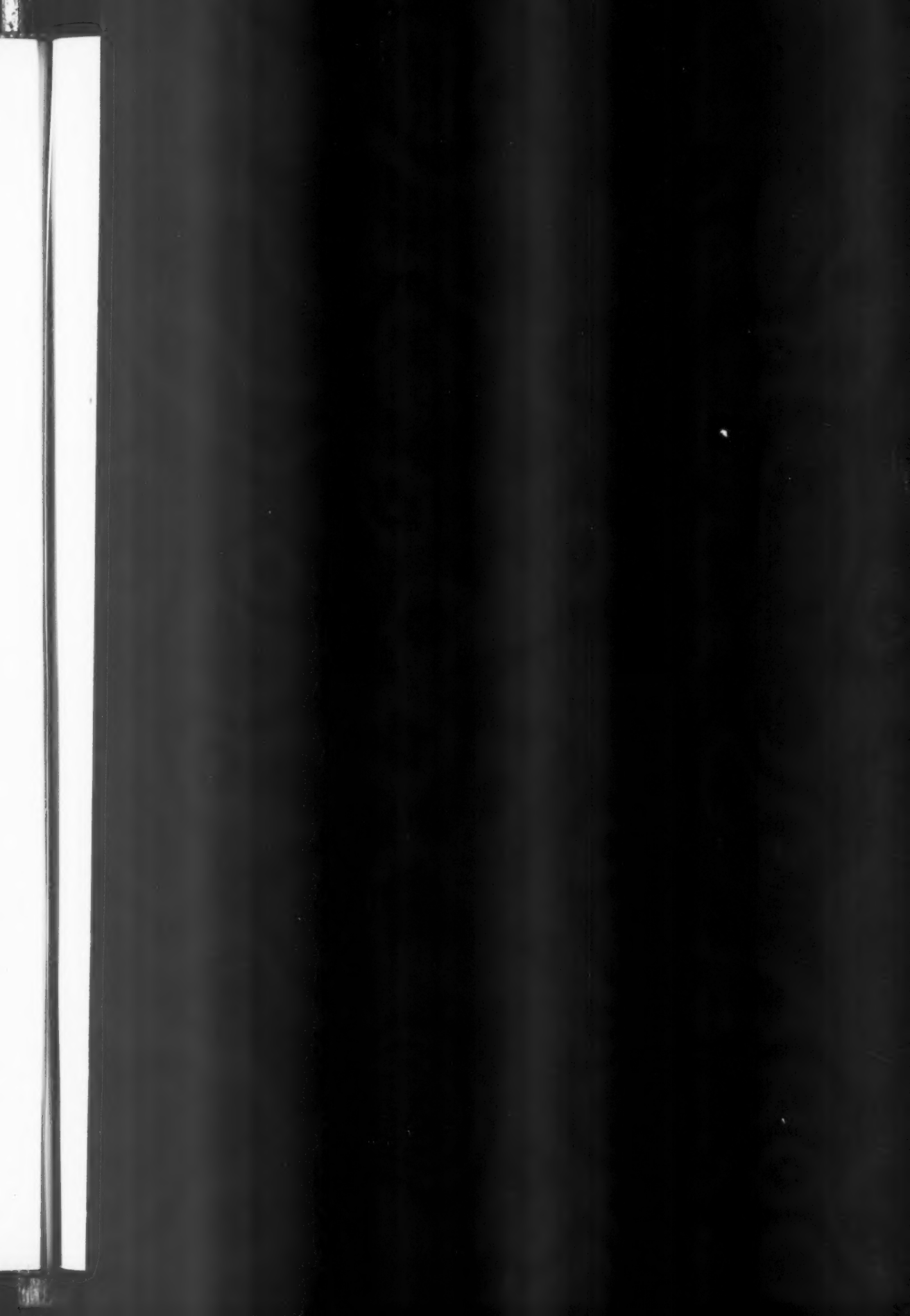
IF YOU WANT THE

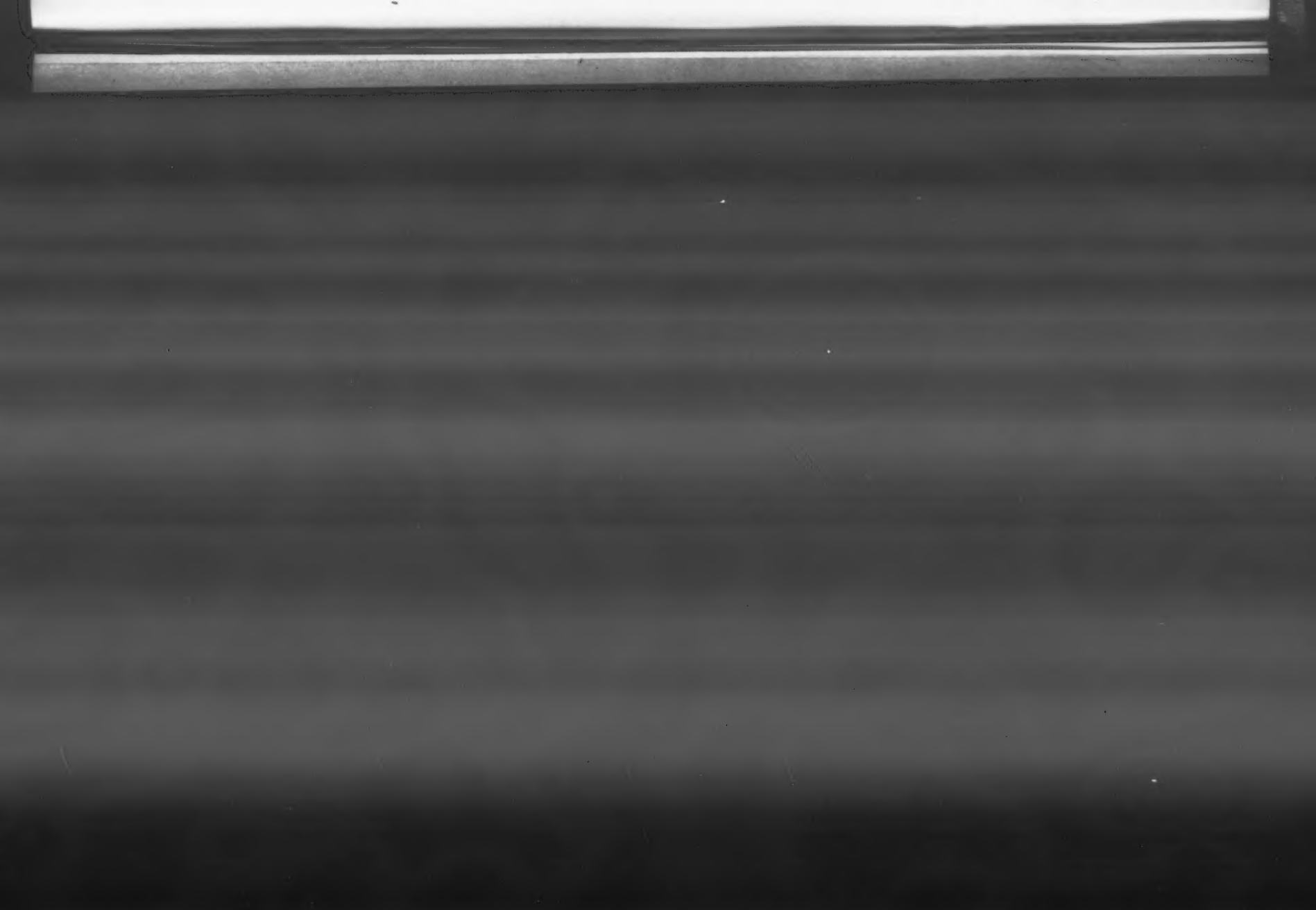
BEST SYSTEM OF BOOKKEEPING FOR WATER COMPANIES

WRITE TO

MUNICIPAL ENGINEERING COMPANY

TO USE IT SAVES AND PAYS





MUNICIPAL ENGINEERING

VOLUME XXXIV. APRIL, NINETEEN HUNDRED EIGHT. NUMBER FOUR.

NEW YORK LAWS RELATING TO THE POLLUTION OF STREAMS.*

By A. H. Seymour, Secretary State Department of Health, Albany, N. Y.

The subject of pollution first received attention in the State of New York in 1885, when the Legislature passed a law providing that the State Board of Health might make rules and regulations for the protection from contamination of potable water supplies within this State. This law, with modifications and amendments, is still in force, and constitutes Sections 70, 71 and 72 of the Public Health Law. Acting under this provision, the State Department of Health has adopted rules and regulations for the sanitary protection of a large number of the potable water supplies of the State, and is every year called upon to extend its authority to other places.

These rules and regulations are prepared after a careful examination of the local conditions by an expert engineer. They are then usually submitted to the local authorities for recommendations, and, after careful consideration, are made sufficient to properly safeguard the water supply, and are then published as provided by law. They then have practically the force and effect of law. Under these rules and regulations, violations may be punished and a watershed may be kept clean. The enforcement is, of course, in the hands of the local authorities, and where violations of these rules exist it is due to the negligence of the officials charged with the duty of enforcing them. This act was an important one as providing a means for protecting the water supply of a city, and acting under the authority of these rules many cities and villages have put their watersheds in ideal condition. Those which have not enforced such rules are being called to account by the department, and the authorities in charge of the water supply and the people using the water will have from time to time the danger of neglect pointed out to them forcibly.

In 1892 an act was passed which provided that a city or incorporated village which has made provision for the disposal of its sewage so as not to pollute or contaminate any stream might maintain an action in the Supreme Court to prevent the discharge of sewage into any water from which it draws its water supply. There are a number of provisions in the forest, fish and game laws designed to prevent the pollution of waters to such an extent that fish are destroyed, and there is also a provision of the penal code prohibiting the discharge of refuse from gas factories, etc., and other noxious or poisonous substances into any of the public waters.

But the most important provision of our laws was the act passed by the Legislature in 1903, constituting at present Sections 75 to 79-d of the Public Health Law, as this act vests the State Commissioner of Health with most of his authority over the subject. It provides, briefly, that no person shall discharge any sewage into the waters of the State unless by permission of the State Commissioner of Health, and that all plans for sewer systems or for extensions or modifications to existing sewer systems must be approved by the State Commissioner of Health and a permit issued by him for the discharge of sewage. It prohibits the discharge of sewage from factories, etc., without permission from the State Commissioner of Health, and makes it the duty of the public health authorities of every municipality of the State to file a report and map of their sewer system as it existed at the time of the passage of the act.

Under this act, when plans are submitted to the Commissioner of Health for approval, he may require the plans of a

*From the Report of the Seventh Annual Conference of Sanitary Officers of New York.

sewage disposal plant to be submitted, and may refuse to allow the discharge of sewage from such a system until a sewage disposal plant has been constructed. It therefore places in his hands very largely the control over future pollution of the streams, but the act, of course, could not prevent the discharge of sewage from sewer systems already in existence at the time of the passage of the act, and this presents a serious question. Unless a city or village desires to extend its sewer system and the Commissioner of Health requires that they take immediate steps for the construction of a sewage disposal plant, the discharge of sewage from that place may be continued indefinitely, unless, of course, a municipality or person below them should secure an injunction restraining them.

In his first address as Commissioner to the health officers of the State, in the conference of 1905, the present Commissioner called particular attention to the subjects of water supply and sewage disposal with relation to typhoid fever. He stated facts and figures to show that typhoid epidemics have been caused by sewage pollution in many of the cities, and that the only safe rule to apply is to eliminate as far as possible the danger of sewage pollution. He further said: "It will be the fixed policy of this department not to grant any permits for the further pollution of our streams by sewage except for very cogent and absolutely imperative reasons." In every official address since that time he has reiterated this policy of the department, although pointing out that the whole subject of the pollution of the waters of the State is one which must be considered from a broad viewpoint before any drastic measures are taken.

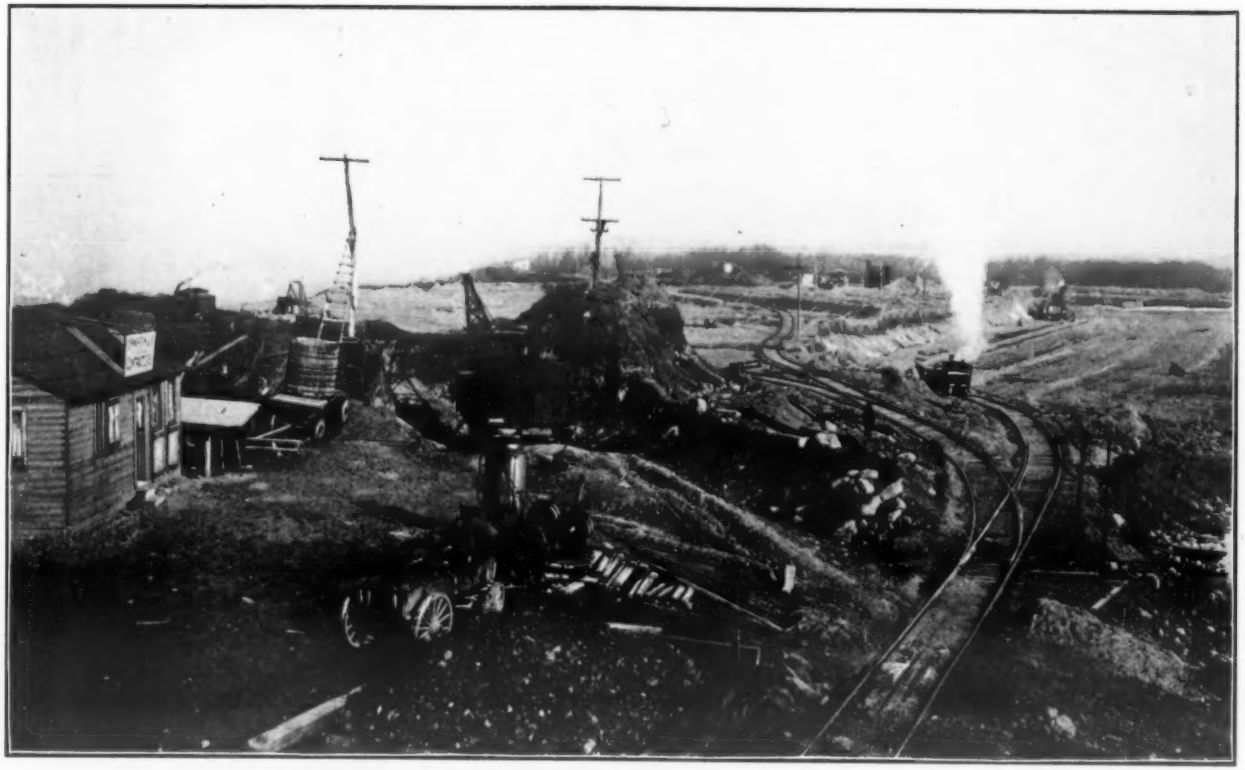
It is alleged that many municipalities are undoubtedly discharging raw sewage into our streams when such sewage should be treated in a disposal plant; but to demand reform in one instance without weighing it in relation to others on the same watershed, complicates the problem rather than helps it. It is surely out of place for the citizens of one municipality to demand drastic measures against their neighbors, when, at the same time, they are taking no steps themselves to correct an existing abuse. The department has therefore undertaken a proper study of the questions in all their bearings, and with due relationship to all that pertains to them ,and it is submitted that this is the only proper policy of a health department, although at times the progress attained may seem to be slow.

With this in mind, and with the very limited appropriation which the department has for this work, it has undertaken to make an examination of, and to carefully map, the watersheds of the State. All possible information is gathered as to the amount of pollution existing and the demands that may be made on the stream in future as a potable water supply.

After carefully weighing the subject in all its aspects, a policy is then adopted by the Commissioner, for the department, to govern its future actions in the granting of permits for the discharge of sewage on this watershed. As a result of this work the department is in a position to point out positively what should be done in certain parts of the State and with certain streams, and when plans are submitted to it for approval it can base its refusal or grant of a permit for the discharge of sewage, upon a report which has been given after careful study and a policy which has been fixed after thorough investigation.

I do not believe I am going too far to say that this work should have been done years ago. Had the State had such a policy ten years ago, a large amount of the pollution would already have been eliminated. The criticism for not doing this, if any there be, must be upon the Legislature, which has failed to provide any funds for the work. The fact that the department has undertaken this work has brought about one of the natural results which follow any particular line of activity, and that is that constant demands are made upon it to undertake work which it cannot do, and to attempt to remedy conditions with which it has no legal authority to interfere. Enthusiastic but ignorant citizens of the State interested in the subject of pollution, whose ideas seem to be that the Commissioner of Health has absolute authority to do anything that he may take a notion to, are constantly writing the department demanding that he issue orders where he has not a shadow of authority, and that he remedy private wrongs which belong in the civil courts; and one recent communication stated that the people of a certain village were suffering with malarial fever and asked that the Commissioner of Health issue an order to relieve them. In many of the cases presented it would be just as sensible for the Commissioner to issue an order that on and after a certain date there should be no more smallpox in the State, but in every case where the department apparently has any authority, or where its advice would be of any assistance, it does and will go as far as its limited means will permit, and make such an investigation and such recommendations, or lend such other assistance as is in its power.

I believe it to be a part of the duties of health officers, as the leading sanitari-



I. COBB'S HILL RESERVOIR, ROCHESTER N. Y.—GENERAL VIEW FROM WEST END, JAN. 1, 1907.

ans of their respective jurisdictions, to discuss these matters when they are brought up, and to assist in educating their people to the importance and necessity of the preservation of our lakes and streams from pollution, not only as a health measure, but also that future lovers of nature may enjoy our streams as they should be able to. Were this indiscriminate pollution to continue, our fishing, boating and bathing, so dear to every lover of out-of-door life, will be a thing of the past.

The discharge of wastes from mills, particularly pulp mills, dye works, tanneries, etc., presents at once an interesting and a somewhat complex question. Under our law every mill or factory owner must secure permission from the State Commissioner of Health to discharge refuse or waste matter into the waters of the State. In issuing these permits the department endeavors to restrict the pollution wherever possible, and it issues no permits except with conditions attached, which permit is revocable at any time. This course is also followed in issuing permits for the discharge of raw sewage from public sewer systems, the effluent from sewage disposal plants, etc., and in this way the operation of these plants is kept under the supervision of the department to a large extent.

The law further provides that the local board of health shall make and maintain such inspection as will at all times enable it to determine whether the act is complied with in respect to the discharge of sewage, refuse matter from mills, etc., into the waters of the State. Upon discovery of violations of the act, it becomes the duty of the local board of health to serve a written notice on the person or corporation responsible for the violation, specifying the violation, and fixing the time within which it must cease. If at the expiration of this time the violation continues, it is the duty of the local board to report the same to the State Commissioner of Health, who shall give a hearing and take proof of the facts, and if he finds the violation to continue, he shall certify that fact to the board of health, which shall then bring an action for recovery of the heavy penalties imposed and for an injunction. The penalty for the discharge of sewage from a public sewer system without a permit is $500, and $50 per day for each day the offense is maintained. The penalty for the discharge of sewage from factories without a permit is $100, and $10 per day for each day the offense is maintained.

Local boards of health should see that these provisions of the law are fully enforced. If sewers are being built in a city or village by individuals or by public authority, they should see if the plans have been properly approved by the department. If factories are constructed which wish to discharge sewage into the waters of the State, see that they have permits or stop the work. Wherever possible require the construction of settling tanks in factories, if they use dyes or colors, before permitting them to discharge into the sewer systems, and save complaints on this score.

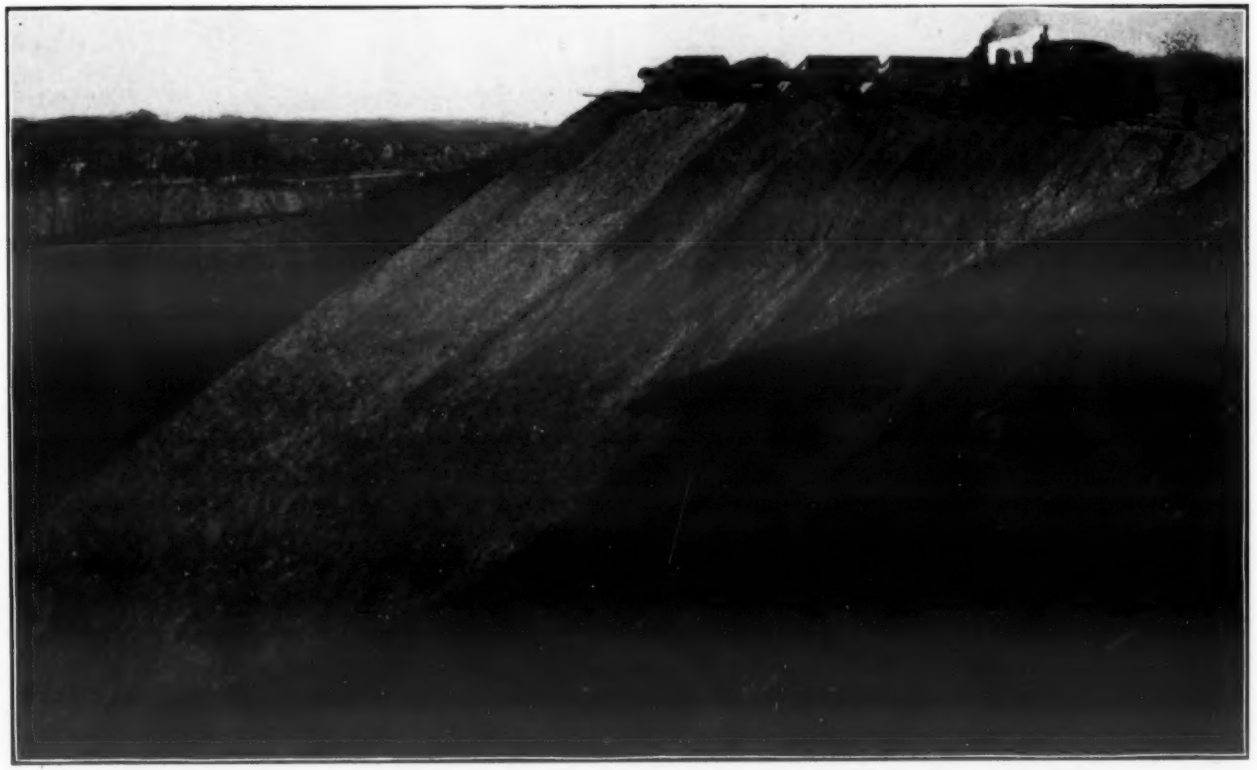
RESERVOIR CONSTRUCTION IN ROCHESTER, N. Y.

The following points of interest concerning the construction of Cobb's Hill reservoir, which is a distributing reservoir for the water works of Rochester, N. Y., are taken from the recently published report of E. A. Fisher, city engineer, for the year 1906. Excavation for the basin was carried on throughout the year, 518,600 cubic yards of earth being moved by four steam shovels. The first of the accompanying photographs shows a general view of the work at the end of 1906, and the location and distribution of the excavating plants at that time. The second photograph shows a dump for the waste material.

The third photograph shows the process of rolling the embankment with a corrugated roller.

The blocks for the retaining walls required are made of concrete, in twenty-foot blocks in place, the forms for the first blocks and the process of filling a form being shown in the fourth photograph. These forms were constructed in large pieces, those for front, back and each end being each a unit. They are handled by a locomotive derrick. Fourteen wall blocks, each of about 107 cubic yards, were constructed in three autumn months, and 204 squares of cement waterproofing were applied to the face of the blocks before frost interfered. Thirty squares of coal tar pitch waterproofing were applied to the concrete bottom under and immediately in front of the toe of the wall blocks.

Early in the summer a 1⅛-yard concrete mixer was installed in connection with a screening plant, with elevator and bins, and early in the fall another mixer was procured. After a short trial it was



II. COBB'S HILL RESERVOIR, ROCHESTER, N. Y.—DUMP, 100 FEET HIGH.

found that the sand and gravel, when wet after a shower, was so sticky that it was difficult to pass it through the screens in sufficient quantities, although two rotary screens were employed. Furthermore, the "run of bank" was so uniform in character and in the quantity of voids contained that it was decided to try mixing cement directly with the sand and gravel as obtained from the bank. Careful measurements of the voids in the unscreened bank material, together with the shrinkage of the same when wet, were made daily, and the proportion of cement prescribed was sufficient to fill the voids as thoroughly as the specified proportions of cement would in the case of the various classes originally specified.

Early in the year a cement house was built by the contractor. It consisted of a long wooden building covered with roofing paper on sides and top, with a railway track through the center. It contained thirty-two rooms, sixteen on each side of the track, and each with a capacity of one carload of cement; each carload usually consisted of 640 bags. An assistant, having the cement testing in charge, sampled sixteen bags from each carload. After the cement had satisfactorily passed the tests, the carload which it represented was released for use upon the work.

COMPARATIVE STRENGTH OF BRICK AND CONCRETE FOUNDATIONS FOR BRICK PAVEMENTS.

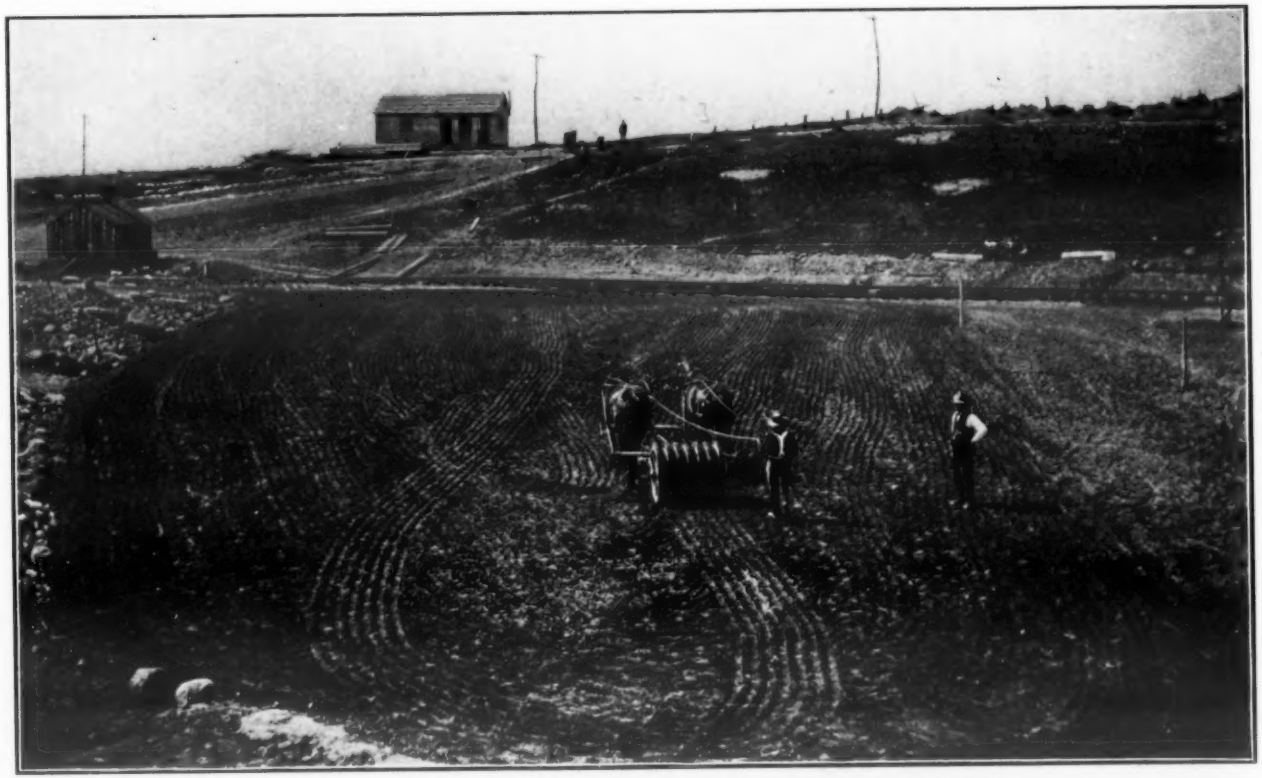
The National Paving Brick Manufacturers' Association has instituted an investigation to determine the relative values of paving brick laid flat and grouted with cement and 6-inch concrete as foundations for pavements, so as to give, if possible, another choice of material where the aggregates for concrete are scarce. The seconds of paving brick can be used advantageously for such foundation. At the request of Secretary W. P. Blair, Prof. I. O. Baker, of Illinois University, has made a series of tests of brick beams which show remarkable results, and show conclusively that a brick foundation is more than equal to a concrete foundation. Following are some extracts from his report upon the first tests made. It is understood that others upon details and the effect of modifications are under way and may be reported upon later. Professor Baker says:

I made six beams about 30 inches wide and 7 feet long, using Terre Haute and Clinton (Indiana) brick, Chicago AA Portland cement, and ordinary building sand. In mixing and using the grout I followed as nearly as I could the standard specifications of your association. In making the first beam the grout leaked out at the bottom of our experimental beam, and in the confusion resulting therefrom the grout was not kept properly stirred, and consequently the results of the first beam are not satisfactory and have not been included in the comparisons to be made later. I then made three beams, using standard grout, which seemed to be reasonably satisfactory.

Your standard specifications for the grout were designed for a form of construction whose chief purpose was to protect the upper edge of the bricks in the pavement from chipping; but in the matter in hand tne purpose of the grout is to give beam-like action to the pavement. For the first purpose the richest grout should be in the top of the joint, but for the second purpose the richest grout should be in the bottom of the joint. Therefore I made two beams, in which I used a grout composed of two volumes cement to one volume of sand from top to bottom. I hope to make another experiment in which I shall use rich grout at the bottom of the joint and the leaner grout at the top of the joint; but in this first experiment I thought it wiser to use the rich grout from top to bottom. It is almost certain that the leaner grout at the top of the joint will not decrease the strength of the beam, and it surely will decrease the cost of the construction.

Below are the results obtained from the six beams which I have thus far broken. The beams were supported at the bottom and loaded at the middle, and all were tested when 33 days old.

Beam No.		Modulus of Rupture.	
1	Standard grout	370.4 lbs. per sq. in.	Terre Haute brick.
2	Standard grout	678.2 lbs. per sq. in.	Terre Haute brick.
3	Standard grout	540.8 lbs per sq. in.	Clinton brick.
4	Standard grout	603.1 lbs per sq. in.	Clinton brick.
	Average	607.4	
5	Grout: 2 cement to 1 sand	627.2 lbs. per sq. in.	Clinton brick.
6	Grout: 2 cement to 1 sand	672.4 lbs per sq. in.	Clinton brick.
	Average	649.8	



III. COBB'S HILL RESERVOIR, ROCHESTER, N. Y.—ROLLED EMBANKMENT.

The modulus of rupture is the term used by engineers in expressing the strength of a beam. It may be defined to the laymen as the stress in pounds per square inch upon the outside fibre at the bottom of the middle of the beam.

Understanding that you desired these experiments made in order that you might determine whether or not it was practicable to advocate the use of a layer of brick with grout-filled joints instead of the usual concrete foundation for pavements, I presume it will be acceptable for me to offer some comparisons between the strength of such a brick beam and of a similar concrete beam.

Before entering upon this phase of the investigation I wrote to eleven large cities not in Illinois and to eight of the larger cities of Illinois, asking for their specifications for pavements. I did this with a view to finding what grade of concrete was used for pavement foundations. I received replies from fifteen of the cities, but only eleven of them had specifications for brick pavements. Below I give the list of the cities, with the kind of concrete which they use. All use 6 inches of concrete. I present first the cities using Portland cement concrete, and, second, those using natural cement concrete.

PORTLAND CEMENT CONCRETE FOR PAVEMENT FOUNDATIONS.

City.	Cement.	Sand.	Aggregate.	Proportion.
Chicago	1	3	6	1:9
Springfield	1	3	5	1:8
Milwaukee	1	3	6	1:9
Columbus	1	4	9	1:12
Washington	1	4	10	1:14
Paris, Ill.	.	..	..	1:9
Indianapolis	1	3	5	1:8
Philadelphia	1	3	6	1:9

NATURAL CEMENT CONCRETE FOR PAVEMENT FOUNDATIONS.

City.	Cement.	Sand.	Aggregate.	Proportion.
Cincinnati	1	2	5	1:7
Louisville	1	2	5	1:7
Paris, Ill.	1	3	3	1:6
Paris, Ill.	.	..	..	1:5
Rockford	1	2	6	1:8

It will be noticed that there is a great diversity as to the proportions of the concrete used in the various cities, and there is still greater variation if we take account of the fact that some proportion the concrete by units of loose cement and some by units of packed cement; and, further, that some use gravel and some use broken stone, and still again some use screened and some use unscreened stone.

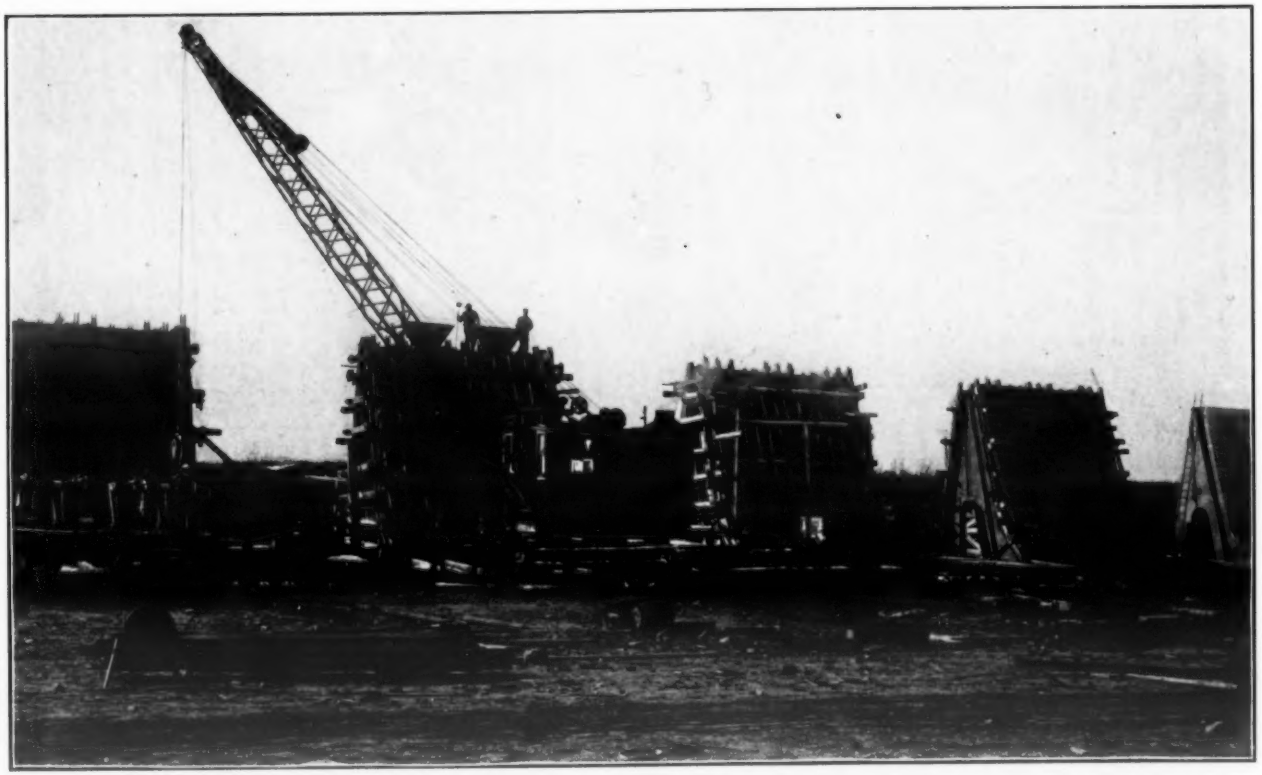
I have examined engineering literature with a view of extracting for your benefit data on the modulus of rupture of concrete; but here again I have found such a variety of results that the best data I can find are far from satisfactory. There are the same variations in experiments as I referred to just before in the concrete used in pavement foundations, and in addition the experiments vary because the tests were made with concrete of different ages and different degrees of wetness and stored in different ways—some in the air, some under damp sand, and some under water. Below are some of the most valuable results that I could find.

Authority.	Age When Tested.	Proportions			Proportions.	Modulus of Rupture—Lbs. per sq. in.
		Cement.	Sand.	Aggregate.		
Baker's Masonry Const. Page 112v.	28 days	1	2½	5	1:7½	*144
	28 "	1	3	5	1:8	88
	28 "	1	2½	6	1:8½	81
	28 "	1	2	3	1:5	145
	28 "	1	3	7	1:10	113
A. N. Talbot...	30 "	1	2	4	1:6	208
Falk (p. 147) ..	40 "	1	3	6	1:9	170
					Average	137
Falk (p. 149) ..	128 "	1	3	5	1:8	196
Sabin.....	1 yr.	1	3	7½	1:10½	204
Falk (p. 146) ..	7½ yrs.	1	2	4	1:6	296
Falk (p. 146) ..	7½ yrs.	1	3	5	1:8	228

The above results are all that I can find in engineering literature with any reasonable expenditure of labor, except some results of experiments made by W. B. Fuller, which are quoted in Taylor & Thompson's "Concrete, Plain and Reinforced," pp. 258-59. These results are, in a rough way, about twice as high as those quoted above, due to two things: first, the use of trap rock instead of limestone, and second, to the unusual care in first separating the various sizes and then recombining them in the best proportions for securing the very highest results. With the present ideals and practice of contractors, it is entirely impracticable to mix concrete with the same degree of care and accuracy as is employed in the above experiments; and therefore I think that Mr. Fuller's experiments are not applicable in this discussion.

When I began to write this report I thought I had several results for natural cement, but apparently I have only one, namely, a result by Sabin for a 1-2-4 natural cement concrete tested at one year, which gives a strength of 159 pounds per square inch. From my general knowledge of natural cement, I am quite sure that this is unusually large, and I think it is safe to say that at a month the strength of natural cement concrete is not more than one-third of that of Portland cement concrete of the same proportions and age. However, this is not a matter of much moment, since Portland is rapidly displacing natural cement; and the fact that a city has specifications permitting the use of natural cement does not prove that it does now use such cement or that it will in the future.

The above data for the strength of concrete are so varied that it is nearly impossible to draw any conclusion as to a



IV. COBB'S HILL RESERVOIR, ROCHESTER, N. Y.—FILLING FORMS FOR RETAINING-WALL BLOCKS.

representative average. I have tabulated the results in the order of the age when tested, and have included only proportions approximately the same as those previously shown to be in use in pavement foundations. Notice that the average modulus of rupture of the results in the table from 28 to 40 days is 137 pounds per square inch. I intended to break the brick beam when 28 days old, but an accident made it impossible to break the first beam until it was 33 days old, and as it was desirable to have all tested at the same age, all were tested when 33 days old. The mean age of the first seven results in the above table is thirty days. It is hardly correct to take averages in this way, but for this purpose it is nearly correct to say that the average strength at 30 days is 137 pounds per square inch. I think this result is higher than will ever be attained in a pavement foundation, for you must remember that the above results are from carefully conducted laboratory experiments, while in practice the concrete is mixed by unskilled labor, with the chief object of obtaining an economical result rather than the greatest possible strength.

Preliminary to making a comparison between the strength of the brick beam and a similar concrete beam, permit me to explain that the strength of a beam varies as the square of its depth; and therefore a beam 6 inches deep will support 2¼ times as much load as a similar 4-inch beam, and practically 3 times (exactly 2.95) as much as a 3½-inch beam, and 4 times as much as a 3-inch beam.

The brick beam referred to at the beginning of this report, made with standard grout, has a modulus of rupture of 607 pounds per square inch, which is 4 times (exactly 4.05) as much as the assumed average for the modulus of rupture of concrete; therefore such a brick beam 3 inches deep will carry as much load as the ordinary 6-inch concrete beam and a brick beam 3½ inches deep will carry 1.4 times as much as a concrete beam 6 inches deep, and a brick beam 4 inches deep will carry 1.8 times as much as a concrete beam 6 inches deep. Further, the beams with the richer grout gave a modulus of rupture of 650 pounds per square inch, and hence such a brick beam will carry 8 per cent. more load, respectively, than the beams just mentioned.

MUNICIPAL IMPROVEMENTS IN MEXICO.

By W. D. Hornaday, Austin, Tex.

The cities and towns of Mexico, at their present rate of progress, will in a few years take front rank with places of corresponding size in the United States in the matter of municipal improvements and public works. The millions of dollars which the federal government of Mexico has contributed towards modernizing the principal seaport towns are only a part of the work that is being done in this line by the interior cities and towns where no federal aid is given. Following the establishment of water works, sewerage and drainage systems, a street paving era is beginning to dawn. Many of the principal streets of Mexico City and Guadalajara have been paved with asphalt during the last few years. Guadalajara has taken the lead in this class of municipal improvement. The adoption of asphalt for street paving in these two cities was largely due to the energy of an American company in introducing its material. The company in question operates at Ebano, near the port of Tampico, where it extracts the asphalt paving material from crude petroleum by the refining process. The petroleum is produced by numerous wells in the Ebano field.

The municipal authorities of Guadalajara and Governor Miguel Ahumada, of the state of Jalisco, have just let the contract for the paving of 50,000 square meters of streets of that city with asphalt. It is stated that 90,000 square meters of asphalt paving had already been laid in Guadalajara, and when the new contract is carried out it will have more asphalt paving than Mexico City.

The municipal council of Pachuca has decided to pave all of the business streets of that city. The contract for this work will soon be let. No estimate has been made of the cost of the proposed work, but it is said that it will amount to a large sum.

The water works and sewer systems which have been under construction in Monterey during the last two years will soon be finished, at a cost of about $5,000,000. It is stated that about eighty miles of sewer and water pipes have been laid in the city up to this time. The work is being done by a Canadian syndicate. The water supply will be taken from two sources. The first of these is the Estanzaduela river, which will be tapped at a point about twelve miles from the city.

The main conduit through which water from this source will be brought to the city is now being constructed. The second source of water supply will be from underground filtration galleries driven through water-bearing gravel at San Geronimo, situated five miles from Monterey. Two large reinforced concrete reservoirs, each having a capacity of 40,000,000 liters, will also be constructed. The main outfall sewer will be about 7½ miles long.

In addition to the construction of water works and sewer systems, the city of Monterey is preparing to do a large amount of street paving. All of the principal streets of the city are to be paved with asphalt and brick. Considerable brick paving has already been laid.

It is announced that the water works system which is being constructed for the city of Aguas Calientes will be finished in about eighteen months. A great dam is being built about twelve miles from the city to form a storage reservoir, from which the water supply will be obtained. This reservoir will have a capacity of about 5,000,000 cubic meters of water. The water will be carried to the city through closed pipes. At present the ancient method of supplying the people of Aguas Calientes with water by vendors, who peddle the fluid from house to house, is in vogue. In time of drouth the price of water is so high as to be almost out of reach of the poorer people.

The city of Oaxaca has begun the construction of water works and sewer systems, which will cost about $500,000 when completed. The municipal authorities recently purchased the waters from the Molina del Lazo, situated near Etla, which will be used to supply the city of Oaxaca. This source of water supply is about fifteen miles from Oaxaca.

An American firm of contractors has just finished the construction of complete and modern water works and sewer systems for the city of Parral, state of Chihuahua, at a cost of $580,000. The systems comprise forty-four miles of sewer and water pipes and a dam and reservoir. It is stated that 1,400 independent dwellings and business houses and 3,200 living rooms in that city have already been connected with the two systems.

The city of Guanajuato, which in times past has been subject to disastrous overflows, has been relieved from all possibilities of a repetition of such events by the completion of a drainage tunnel which will afford a quick outlet for the surplus waters. The construction of the tunnel cost about $2,000,000. That city has in contemplation other important public improvements.

The construction of modern systems of water works and sewers for the city of Torreon by an American firm of contractors, which has been in progress for the last two years, is now practically finished. This city is planning to do a large amount of street paving.

The great Chuviscar dam, which is being erected near Chihuahua to afford a works system of that city, will be finished water supply for the proposed water in July next, at a cost of about $750,000. When this work is completed the construction of the remainder of the water works system in that city will be started. It is estimated that the expenditure of an additional sum of more than $500,000 to complete the public works will be required. The streets of Chihuahua are to be paved and other public improvements inaugurated.

Plans have been prepared for complete water works and sewer systems to be constructed for the city of Juarez, state of Chihuahua. The probable cost of these proposed improvements is not publicly known at this time.

The lower part of the city of Tampico is to be raised and the laguna del Carpintero, adjoining that town, is to be filled in. These improvements will cost about $3,000,000. The work is already in progress.

Many of the public works now in progress in different cities and towns of Mexico are being carried out without the issuance of bonds. The state and municipal treasuries are plethoric, and in many instances the work is not begun until the money is on hand to pay for the improvements. Parral and a few other cities issued bonds, however, for their public works, and these bonds found a ready sale in the United States.

PURIFICATION OF WATER SUPPLY AT LAWRENCE, MASS.

By J. Rodney Ball, Lawrence, Mass.

For the first time during an interval of nearly eight years the city of Lawrence, Mass., has a water supply sufficient for its needs. The old open filter, completed in 1893, the first one of its kind in America, had done wonderful work in the elimination of the terrible typhoid scourge to which the city had been subjected in

the years previous to its construction. As the new century drew near, it became obvious to those who had knowledge of water supply that the unprotected filter beds, covered almost continually through the cold New England winter with from six inches to three feet of ice, could not be relied upon to maintain a proper volume in the reservoir to insure filtered water for the thousands of people in the rapidly growing city. The first filter, practically two and one-half acres in area, with a capacity of five million gallons per day, was built in one unit, and in order to scrape the river silt accumulation from the sand the entire filter must needs be drawn off some forty times per year. During the summer months the reservoir was kept at capacity at all times and whatever reduction in water supply was occasioned by this idleness of the filter was not such as to be noticeable. In the winter, however, it became necessary to remove the cumbersome ice from the beds almost continually. The reduced volume which it was possible to filter, owing to the small water space between the ice and the sand, reduced correspondingly the reservoir surplus, and the few days lost in the process of scraping meant much to the available store of filtered water.

In 1903, according to plans of Superintendent M. F. Collins, of the Lawrence Water Works, two walls of concrete were constructed, dividing the filter unit into three beds, thus making it possible to draw water from one of the three and permit the working of the remaining two sections. These dividing walls aided materially in the hoarding of supply, but the work was recognized as a makeshift, and the attention of the city government was directed to the need of a new and additional filter. Messrs. Chapin and Knowles, of Pittsburg, Pa., were engaged as engineers. This firm produced plans for a covered slow sand filter, and these were approved by the municipality. No appropriation was made, and the matter rested in abeyance until the fall of 1904. The next spring the driven well project was taken up. The summer was spent in almost hopeless search for water producing lands, on which $5,800 were spent before it was demonstrated to the City Council that a suitable supply from this source was impossible.

Following this, those who were opposed to another filter on ethical or political grounds sought to procure water from some pond or lake within reasonable distance, but when this failed, the State Board of Health directed the city to proceed with the carrying out of the new filter plans. Still there was delay, and finally the committee on water supply of the state legislature ordered the new work begun within one week, under penalty of the settlement of all bills contracted by the State Board of Health, which would be called upon to do the work. This precipitated action on the part of the government, and $70,000 was appropriated for the new filter. On May 25, 1906, the contract was awarded to Michael O'Mahoney, of Lawrence, whose bid was $47,543, the lowest of four, the highest being about $85,000. Operations were begun without delay. The contract date of completion, November 15, 1906, was extended for rea-

LAWRENCE, MASS., WATER FILTER.
View taken after collapse of roof during construction.

LAWRENCE, MASS., WATER FILTER.
Showing main collector, branch pipe collectors, gravel filling, groined arch roof and supports.

sons apparently satisfactory. To bridge over the time until the new supply could be brought into use, on January 7, 1907, the citizens of Andover, at town meeting, voted to allow Lawrence an auxiliary supply. The connections were made, and the city used 50,000,000 gallons of water during the winter, paying therefor $4,500. Even with this connection a shortage was imminent, and the Legislature passed an act on February 9 enabling the city of Lawrence to take water from the mains of North Andover. On the 14th day of February water was turned into the city mains, one thousand feet of pipe having been laid in the meantime. There were 37,000,000 gallons of North Andover water used, at a cost, including the connections, of $5,500, making a total of $10,000 expended in tiding over an emergency created by dilatory tactics on the part of city governments.

November 1, 1906, the first concrete of the new plant was laid, and by the first of the following month the roof over the first four anad one-half bays had been laid. The piers were in readiness on this date for three bays more, but it was impossible to lay concrete, owing to the fact that until the 17th the temperature did not rise above 28 degrees F. The temperature dropped below freezing the last of November, 1906, and there was no perceptible thaw until the next March. On the 17th of December, however, the contractor covered the remaining rows of piers, and as soon as this was done, covered the work with six inches of straw and two and one-half feet of sand and gravel. Nothing more was done during that year.

April 3 of the next year, 1907, the contractor began the removal of the wooden forms used in concreting, and a large part of the roof collapsed. The history of this collapse is given on page 138 of the March number of MUNICIPAL ENGINEERING. The first of the accompanying photographs shows the filter after the collapse and can be studied in connection with that description.

The new plant was completed in December, 1907, and was at once put into operation, the water going through being submitted to daily tests by the State Board of Health, to determine when it should have reached a bacterial efficiency such as to permit of its being pumped into the reservoir. January 3, 1908, the State Board wrote:

> Daily examinations of the water filtered by the new Lawrence filter during the past month indicate that although the numbers of bacteria are not yet reduced to the same extent as in the water filtered by the old city filter, the reduction is such that in the opinion of the State Board of Health the water now filtered may be used for domestic purposes if the rate of filtration is not allowed to exceed one million gallons in twenty-four hours.

Consequently, on this date the water was turned into the reservoir, but at this writing the free and full use of the filter has not been permitted.

The new filter is three-quarters of an acre in size, and more than one-half of it is built out in the river bed, the outside embankment being protected by a coffer dam lined with sheet piling. There were

35,000 cubic yards of earth removed in excavation and 29,000 cubic yards of cement were laid. The bed is twenty-one bays long by seven bays wide, each bay being fifteen feet in width. There is no sand run provided, contrary to the original plans, as it is the intention to wash all sand on a section of the roof in the center of the filter. Here a space six bays square has been constructed on nine inches of concrete, reinforced with twisted steel rods extending in both directions, covered with twelve inches of cinders, and the whole covered with four inches of concrete. The sand is brought to the roof by the use of pipe lines with ejectors, and a reduction of cost of washing from the $5.50 to $8 per million gallons per year in the old filter to $2.50 in the new is expected. Under old conditions it was necessary to cart all the sand out of the filter by means of wheelbarrows, then washing it and returning it in like manner.

The filter is built in a rectangular shape, approximately 315 feet long by 115 feet wide. The floor is built in the form of inverted groined arches, 6 inches thick at the centers and 15 inches thick under the piers. The concrete piers supporting the vaulting are 15 feet center to center and 22 inches square down to the sand line. From this point they batter out to 2 feet 6 inches at the base. The outside walls are 24 inches thick at the neat lines, with the outside batter varying from one in five to one in twelve, according to position. The vaulting is built of concrete in the form of semi-elliptical groined arches, with a clear span of 13 feet 2 inches, rise of 2 feet 9 inches, 6 inches thick at the crown and 21 inches thick over the piers. Ventilator openings are provided for the admission of light and air during scraping. The photographs show these details.

The underdrain system consists of a concrete main collector in the form of an arch above the general floor level, running the whole length of the filter, in the outer bay. This collector is provided with manholes to admit of cleaning. From this main collector the laterals start out as 12-inch terra cotta channel pipe, laid with open joints, and after a distance of about 15 feet reduce to 6-inch terra cotta pipe and extend to the center of the outside bay. There are 12 inches of gravel spread about and over the underdrains and 4½ feet of sand above them. The second photograph shows the main drain before covering and the lateral drains surrounded by the underdrain gravel.

LAWRENCE, MASS., WATER FILTER.
Showing sand filter ready for use and channel for distributing water to filter when filling.

In the operation of the filter the river water is carried from the old gate house by gravity through a 20-inch cast iron pipe, to the inlet chamber in one corner of the filter, where the flow is regulated by a valve of special design. The water overflows the weirs in the walls of this chamber and is carried by open troughs along the sides of the filter, the inflowing water being thus distributed over the whole area of the bed without disturbing the sand. The water filters down through the sand and gravel into the laterals, is

carried by them into the main collector, passing out by gravity, through a 20-inch cast iron pipe, into the pump wells of the pumping station.

The entire work was done under the supervision of engineer Morris Knowles, of the firm of Chapin & Knowles, and chief engineer of the Bureau of Filtration, Pittsburg, Pa., city engineer Arthur D. Marble, of Lawrence, and superintendent Michael F. Collins, of the Lawrence water works.

An experiment was tried in the concrete work in this filter, comprising the covering of the wooden roof arch forms with tarred paper, with the expectation that this would enable them to be withdrawn from the concrete with less difficulty and leave a much smoother surface. This resulted disastrously, however, as the paper became firmly attached to the concrete, and it was only after great effort that it was removed from the walls. Needless to say, this experiment was abandoned and recourse had to the old wooden forms, well oiled.

The actual cost of the new filter was $54,331.48, and this, with $85,380 invested in the original filter, comprises an amount of practically $140,000 which Lawrence has put into her work of purifying the water of the Merrimack river in order that her citizens may use it for personal and household purposes without fear of sickness and death. This river is the sewer for 500,000 people, and it is estimated that during the extreme low water the percentage of sewage in the river is one to every forty gallons of water.

Chairman Hiram F. Mills, of the committee on water supply of the State Board of Health, has estimated that during the sixteen years that filtered water has been used in Lawrence it has, by decreasing the number of deaths, added 5,500 people to the population. He explains his assertion as follows:

When the polluted water was used for drinking purposes the death rate was increasing much faster than the population, on account of the continued increase in the pollution of the river water, which received sewage from the growing cities up river. The death rate had been continually increasing until 1892, the year before the filter was built, when the deaths reached the rate of 26 per 1,000 of inhabitants per year. In 1894, the year after the filter was completed, the actual number of deaths had decreased about 300, and the rate was then 19 per 1,000 per year. In 1906 the deaths numbered 1,330, or but 6 per cent. more than in 1892, 14 years previous, and reducing the rate per thousand from 26 in 1892 to 17.5 in 1906. If the rate of 1892 had continued without any increase up to this time, there would now be 52 per cent. more deaths than at present, i. e., there would now be 1,976 deaths per year instead of 1,330.

During the past three years there have been 8.5 per cent. more deaths than in three years next previous to the building of the filter, although the population has increased in 14 years 65 per cent. Of this addition of 65 per cent., or 29,000 persons, to the population, it is evident that as many as 5,500, or about one-fifth of the whole increase, has been due to the increased healthfulness of the city.

COST OF REPAIRS OF ASPHALT, BRICK AND STONE PAVEMENTS IN ERIE, PA.

The annual report of Ben E. Briggs, city engineer of Erie, Pa., for the year 1907, has been presented to the city council, and we are indebted to Mr. Briggs for the opportunity to take out of the report the following information regarding the cost of repairs made on streets paved with asphalt, with brick and with stone in that city. For convenience the information is arranged in tabular form, and the streets are arranged in the order of the age of the pavements. The figures as to cost of repair for the years 1905 and 1906 are added to the table, and some averages are arranged in the accompanying tables of summaries.

Mr. Briggs states that the figures given are for general repairs, except where otherwise noted, and do not include the cost of repairing necessary cuts in the pavements for sewer, gas and water connections.

Asphalt repairs were contracted for in 1907 at $1.10 per square yard for concrete base and $1.15 per square yard for top and binder.

Brick and stone pavements were repaired by day labor, under the supervision of the city engineer, at an average cost less than one-half the price paid in 1906 under contract.

The first table gives the data concerning the asphalt pavements and the total cost and the cost per square yard of pavement of the repairs made in each of the last three years.

It will be noted that the first pavement had a guaranty period of ten years, that those laid in the years from 1887 to 1892 had a guaranty period of five years, and those laid since that time one of ten years. Several pavements, marked * in the tables, the guaranties on which expired in 1892 to 1895, and two which were

I. ASPHALT PAVEMENT REPAIRS IN ERIE, PA.

Street.	Year laid.	Area. Square Yards.	Cost per Square yd.	Years of Guaranty.	Cost of Repairs. 1905 Total.	1905 Pr. sq. yd. Cts.	1906 Total.	1906 Pr. sq. yd. Cts.	1907 Total.	1907 Pr. sq. yd. Cts.	Square yds. repaired in 1907.
9th, Peach to Walnut	1882	7,065.5	$1.49	10	.....	.....	.....	.....	$1,232.33	17.4	1,071.6
5th, State to Peach	1887	1,130.0	2.78	5	$3.45	0.3	$5.10	0.4	14.14	1.3	12.3
5th, Peach to Sassafras	1887	2,069.0	.....	....	.....	.....	.....	.....	284.15	13.7	*
Sassafras, 8th to 10th	1887	2,200.0	2.52	5	90.05	4.1	38.18	1.8	100.90	4.6	87.7
Sassafras, 15th to 18th	1887	3,371.0	.....	....	.....	.....	.....	.....	462.95	13.7	*
Sassafras, 15th to 14th	1887	793.0	2.65	5	14.61	1.8	306.32	38.6	6.75	0.8	6.2
11th, State to Cherry	1888	13,1[illegible]3	.....	....	.....	.....	.....	.....	1,809.34	13.7	*
5th, Holland to French	1890	2,094.5	.....	5	65.78	3.1	52.12	2.5	7.18	0.3	6.3
9th, Chestnut to Walnut	1890	2,045.0	2.68	5	33.85	1.7	68.70	3.4	162.22	7.9	141.0
12th, State to Parade	1890	11,556.3	.....	....	9.57	0.1	39.64	0.1	1,587.00	13.7	*
13th, Peach to Sassafras	1890	1,949.5	2.75	5	.....	.....	.....	.....	49.29	0.3	42.8
18th, State to Liberty	1890	13,835.0	2.81	5	1,744.00	12.6	412.36	3.0	649.63	4.7	565.4
Sassafras, 5th to 8th	1890	3,889.0	2.65	5	47.15	1.2	107.25	2.8	307.84	7.9	267.7
6th, Walnut to Cherry	1891	3,097.3	2.75	5	9.80	0.3	60.26	1.9	234.72	7.6	204.1
7th, French to Sassafras	1891	4,435.0	2.85	5	35.45	0.8	262.19	5.9	210.97	4.8	187.9
10th, State to Peach	1891	1,728.2	2.93	5	324.44	18.8	106.11	6.1	222.87	12.9	193.8
4th, Sassafras to Walnut	1892	5,595.0	2.90	5	51.40	0.9	323.58	5.8	199.13	3.6	173.2
Cherry, 6th to 11th	1892	7,562.0	2.81	5	24.90	0.3	150.58	2.0	284.46	3.8	247.4
French, 11th to 16th	1892	5,827.5	2.81	10	18.70	0.3	541.12	9.3	52.77	0.9	45.9
State, 11th to 12th	1893	1,734.8	1.98	10	49.54	2.9	105.65	6.1	168.39	9.7	147.0
State, 14th to 18th	1893	7,678.4	2.90	10	198.69	2.6	787.68	10.3	706.82	9.2	618.0
7th, Sassafras to Cherry	1894	8,488.0	2.87	10	275.65	3.2	105.38	1.2	875.62	10.3	774.1
8th, Cherry to Cascade	1894	5,585.4	2.47	10	37.97	0.7	123.74	2.2	290.52	5.2	289.3
11th, Cherry to Liberty	1895	3,605.0	2.04	10	.....	.....	14.57	0.4	.....	.....	.....
Chestnut, 8th to 12th	1895	4,418.0	2.32	10	.....	.....	.....	.....	4.98	0.1	4.3
Walnut, 4th to 8th	1896	4,732.7	2.40	10	4.13	0.1	33.66	0.7	3.84	0.1	3.3
Chestnut, 4th to 8th	1896	4,732.8	2.36	10	120.31	1.4	.....	.....	24.18	0.5	21.0
Myrtle, 4th to 12th	1896	8,868.6	2.35	10	.....	.....	.....	.....	.....	.....	.....
6th, Peach to Walnut	1900	12,329.0	1.49	10	.....	.....	.....	.....	9.11	0.1	7.9
8th, State to Parade	1900	8,421.7	1.49	10	.....	.....	.....	.....	612.33	7.3	532.5
18th, State to Parade	1900	6,905.5	1.49	10	.....	.....	.....	.....	57.58	0.8	50.0
Sassafras, 10th to 12th	1900	3,342.3	1.49	10	.....	.....	.....	.....	.....	.....	.....
5th, State to French	1901	1,255.0	.....	....	.....	.....	.....	.....	172.35	13.7	*
8th, State to Cherry	1901	10,625.8	.....	....	.....	.....	.....	.....	1,459.21	13.7	*
5th, Sassafras to Walnut	1902	5,750.5	2.00	10	.....	.....	.....	.....	86.26	1.5	**
21st, Peach to Sassafras	1902	2,060.0	1.90	10	.....	.....	.....	.....	30.95	1.5	**
21st, Sassafras to Ch'sn't	1902	4,426.9	1.81	10	.....	.....	.....	.....	55.34	1.3	**
Peach, 2d to Front	1903	446.7	1.97	10	.....	.....	.....	.....	4.47	1.0	**
6th, French to Parade	1905	7,879.5	1.49	10	.....	.....	.....	.....	986.17	12.5	***
Parade, 6th to 14th	1906	18,028.2	1.97	10	.....	.....	.....	.....	3,628.03	20.1	***
Totals		224,739.9	.....	....	.....	.....	.....	.....	.....	.....	.....
Totals, excluding special contracts		144,095.4	.....	....	.....	.....	.....	.....	$17,054.79	7.6	5,700.7
					.....	.....	.....	.....	6,484.57	4.5	.....

laid in 1901, are under a ten-year maintenance contract, on which 13.7 cents is paid per year per square yard of pavement under the contract. Pavements marked **, laid in 1902 and 1903, did not have the usual guaranty period, but are under a contract for which the contractor bid a lump sum per year to maintain the pavement for ten years, which appears from the figures in the tables to be from 1 cent to 1.5 cents per square yard per year. Two streets seem to have been put under a re-paving contract, one in 1905 and one in 1906, to be paid for in ten annual instalments, which are apparently 12.5 and 20.1 cents per square yard per year for the respective contracts. They are marked *** in the tables.

The second table gives a summary by years of the results for the various pavements. The pavements whose guaranties expired in 1905 and 1906 had small maintenance charges in 1907. Those whose guaranties expired previous to 1905 show variations of several cents in the three years for which figures are given in the first table, and the same variations show to some extent in the averages given in the second table. The second table also shows the judgment of the contractors regarding the cost of maintaining new pavements for the first ten years of their life, marked ** in the tables, and of maintaining old pavements, on which guaranties have expired, for the same length of time, marked * in the tables. Even

though the figures for general repair cost are so variable, they, as well as the contract prices, are very instructive.

In his report Mr. Briggs says:

The pavements of the entire city are in excellent condition, except for the gutters in a few of the oldest asphalt pavements. The annual appropriations for repairs to asphalt pavements have been small, averaging about $2,000 for a number of years prior to 1907, and consequently it has been necessary each year to leave a great deal of unfinished work on many of the oldest pavements. In judiciously expending the funds it was deemed advisable to repair only the central portion of the pavements, which act has resulted in the gutters, three or four feet in width, on a number of the old pavements, becoming very bad. They are in such condition now that I estimate it will require $5,000 to repair them properly. As the defective gutters seem to be due to a decay or disintegration which is a peculiarity of some asphalts, it would seem advisable to use a material that would not decay. I would therefore recommend that authority be given for renewing the gutters in one or more blocks on West Seventh street with small paving brick laid flat on a bed of mortar. The life of such a gutter would be practically unlimited, whereas the life of asphalt gutters varies from four to fifteen years.

The present system of making repairs to all kinds of pavements, as described above, is very satisfactory, and in my opinion could be improved upon only by the city owning an asphalt plant, which, to be a paying investment, would necessitate the city laying all the asphalt pavements. A few cities much larger than Erie are, I believe, successfully operating plants. Although I consider it advisable to dispense with the contractor to a certain extent, and the city do more of the work, thereby doing away with the guaranty, I would not recommend that the city instal an asphalt plant until it is prepared

II. SUMMARY OF ASPHALT PAVEMENTS.

Number of streets.	Year laid.	Guaranty expired.	Total area laid.	Cost of repairs, cents per square yard.		
				1905	1906	1907
1	1882	1892	7,065.5	.....	.....	17.4
3	1887	1892	4,123.0	2.6	8.5	3.0
2	1887	1892	5,440.0	.....	.....	13.7
1	1888	.....	13,175.3	.....	.....	13.7
5	1890	1895	23,813.0	8.0	2.7	4.9
1	1890	.....	11,556.3	0.1	0.1	13.7
3	1891	1896	9,260.5	4.0	4.6	7.2
2	1892	1897	13,157.0	0.6	3.6	3.7
1	1892	1902	5,827.5	0.3	9.3	0.9
2	1893	1903	9,413.2	2.6	9.5	9.3
2	1894	1904	14,073.4	2.2	1.6	8.2
2	1895	1905	8,023.0	.....	0.2	0.1
3	1896	1906	18,341.1	0.7	0.2	0.2
4	1900	1910	30,998.5	.....	.....	2.1
2	1901	.....	11,880.8	.....	.....	13.7
3	1902	1912	12,237.4	.....	.....	1.5
1	1903	1913	446.7	.....	.....	1.0
1	1905	1915	7,879.5	.....	.....	12.5
1	1906	1916	18,028.2	.....	.....	20.1

III. BRICK PAVEMENT REPAIRS IN ERIE, PA.

Street.	Year laid.	Area, Square Yards.	Cost per Square yd.	Years of Guaranty.	Cost of repairs.						Square yds. repaired in 1907.
					1905		1906		1907		
					Total	Pr. sq. yd. Cts.	Total.	Pr. sq. yd. Cts.	Total.	Pr. sq. yd. Cts.	
4th, State to French.....	1893	771.0	$2.32	10	.....	.....	.....	.....	.....	.....	.....
10th, Parade to State...	1893	11,375.3	1.74	10	.....	.....	$176.12	1.55	.....	0	.....
10th, Peach to Cherry...	1893	16,115.4	1.74	10	.....	.....	2.80	0.02	$8.00	0.05	20.0
17th, Peach to Cascade..	1893	18,532.2	1.90	10	$7.09	0.04	12.40	0.07	.....	0	.....
9th, Walnut to Cherry..	1894	2,060.7	1.32	10	.....	.....	3.50	0.17	137.00	6.65	514.0
9th, Cherry to Liberty...	1896	3,367.6	1.49	10	.....	.....	.....	.....	1.75	0.01	1.8
10th, Parade to East ave.	1896	18,616.3	1.46	10	.....	.....	.....	.....	.....	0	.....
State, 12th to Turnpike..	1896	3,295.9	1.38	10	.....	.....	153.53	4.66	198.42	6.02	173.6
Holland, 16th to 26th....	1896	11,356.6	1.51	10	.....	.....	.....	.....	.....	0	.....
5th, Holland to Parade..	1902	4,556.2	1.5[illegible]	10	.....	.....	.....	.....	45.56	1.00	**
7th, French to Wallace..	1902	8,539.2	1.54	10	.....	.....	.....	.....	85.76	1.00	**
Holland, 8th to 13th....	1903	5,672.4	1.44	10	.....	.....	.....	.....	54.02	0.95	**
Holland, 13th to 15th....	1903	2,286.8	1.55	10	.....	.....	.....	.....	22.87	1.00	**
Totals		106,545.6	.....	....	.....	.....	.....	.....	$553.38	0.52	709.4
Totals, excluding special contracts		85,491.0	.....	....	.....	.....	.....	.....	345.17	0.40	709.4

to operate it with some assurance of success.

This leads to the question of the advisability of continuing the ten-year guaranty clause and bond in our contracts, in which the contractor agrees to keep a pavement in repair for a term of ten years. This important question was extensively discussed at the October meeting of the American Society of Municipal Improvements, and the general opinion expressed was against long-time guaranties. A good bond filed in the city hall will not always insure a good pavement, nor satisfactory maintenance for ten years. My experience with paving in this city for the past fourteen years leads me to make the statement that a pavement of which the material and workmanship are first-class does not require a guaranty. I would suggest for consideration three propositions, any one of which might be acceptable as a solution of the guaranty question.

The first is to require on all contracts a local construction bond, with a short time guaranty, say one year, and also retain from the total amount due on a contract 10 per cent. for a term of five or ten years, covering possible defects in workmanship or materials, but pay to the contractor annually whatever interest the sum retained would earn.

The second proposition is the same as the first as to bond and short guaranty, but instead of retaining a certain per cent. the city should have an expert chief inspector thoroughly test and pass upon all materials. Then in the laying of asphalt pavements the contractor would be required to furnish all labor and materials and plant, and the city would take charge of the work at the plant and on the street.

The third proposition is the same as the second, except that the city should purchase and furnish such materials as brick and asphaltum at cost, on all paving contracts. Under such an arrangement the materials could be contracted for early enough to allow sufficient time for making analyses and tests before they would be required for the street.

The arguments for and against these propositions are too numerous to detail in this report. I will state, however, that, in order to carry out successfully the second or third plan, it would be necessary to employ temporarily, as other cities are doing, one of the very few expert asphalt chemists to be had in this country, and establish a laboratory for testing all the materials. If this department was equipped with a testing laboratory, as it should be, it could then be held responsible for the class of materials used in paving.

The third table gives the information in Mr. Briggs's report about repairs to brick pavements, with the addition of the figures for the two preceding years. As in the first two tables, the streets marked ** are under special contract with the contractor who laid them for a lump sum per

IV. SUMMARY OF BRICK PAVEMENTS.

Number of Streets.	Year Laid.	Guaranty Expired.	Total Area Laid.	Cost of Repairs, Cents per Square Yard.		
				1905	1906	1907
4	1893	1903	46,793.9	0.02	0.41	0.02
1	1894	1904	2,060.7	.....	0.17	6.65
4	1896	1906	36,636.4	.....	0.42	0.55
2	1902	1912	13,095.4	.....	.....	1.00
2	1903	1913	7,959.2	.....	.....	1.00

V. STONE PAVEMENT REPAIRS IN ERIE, PA.

Street.	Year Completed.	Area Sq. Yds.	Cost of Repairs, 1907.		Yards Repaired 1907.
			Total.	Pr. sq. yd Cents.	
11th, State to Parade	1874	8,113	.....	.....	.....
Parade, 14th to 18th	1874	10,436	.....	.....	.....
French, Front to N. Park	1876	7,753	.....	.....	.....
French, S. Park to 11th	1876	6,610	.....	.....	.....
9th, State to French	1882	1,100	.....	.....	.....
16th, State to Peach	1885	910	.....	.....	.....
16th, State to Parade	1886	9,269	$83.70	0.90	199.3
Holland, R. R. to 16th	1886	782	29.85	3.82	73.5
Turnpike	1890	711	.....	.....	.....
9th, Parade to French	1890	6,756	.....	.....	.....
14th, State to Sassafras	1894	3,304	.....	.....	.....
Holland, 2d to Front	1901	1,454	.....	.....	.....
24th, State to Peach	1902	1,103	.....	.....	.....
26th, State to Peach	1902	1,464	.....	.....	.....
State, Front to Dock	1902	3,630	.....	.....	.....
Ash, 15th to 18th	1902	1,654	59.43	3.59	141.5
Front, State to Sassafras	1903	3,052	.....	.....	.....
State, 2d to Front	1904	1,521	.....	.....	.....
Front, State to French	1905	974	.....	.....	.....
Totals		70,595	$172.98	0.25	414.3

year for maintenance of the pavement for ten years from the date of completion, which is practically equal to one cent per yard per year. The other streets were repaired by day labor and the figures show that this method is a success from a financial standpoint, in all but three or four cases the cost being much less than one cent a yard per year.

The fifth table shows the cost of repairing stone paved streets, which is extremely low, although a large proportion of the stone streets are far the oldest pavements in the city.

CONTINUITY OF REINFORCEMENT IN REINFORCED CONCRETE STRUCTURES.*

By E. P. Goodrich, New York City.

Concrete structures exhibit the usual phenomena of elastic solids, especially when they are provided with a skeleton of steel, properly proportioned and distributed throughout the concrete mass, according to circumstances. In the construction of concrete sidewalks and of most retaining walls, especially if of massive design, special effort is made to reduce within certain limits the size of the parts which will act as units. In some arches, efforts have been made looking toward a similar result, but in structures of that class the present tendency seems to be to treat them frankly as continuous elastic structures, even though their detailed design is thereby rendered quite complicated. In such structures as lines of concrete pipes separate units are being employed even when of large diameters, but most work is of the continuous or monolithic variety.

No half-way course is possible between these two classes of structures. If an arch is designed without joints, but the reinforcement is not arranged for a continuous structure, joints are almost certain to form in accordance with Nature's laws by the cracking of the work, and sometimes they may occur at points which even threaten the stability of the structure. At least they are often exceedingly unsightly. A concrete sewer is out of sight and usually so arranged that there is little danger of collapse should a few small cracks occur. But in this case another danger may exist. In a small city in a Middle Western State, a sewer was found to have become clogged so that it burst and flooded the cellars of adjoining property. Investigation showed that a root from a willow tree had entered the sewer through what must at first have been a very small crack, and had multiplied its fibers within the sewer to such an extent as to cause the trouble above mentioned.

The matter of building design will be more fully discussed a little later.

From even the two cases above cited it would seem all important when a concrete structure is to be constructed monolithic in character, so to distribute its reinforcement as to make it act like a continuous solid, and in its design treat it as an elastic structure subject to stresses and strains of its own weight, from the live load and its impact and variation in intensity, from changes of temperature, local settlement, etc. What follows will be almost entirely a discussion of the subject of continuity, as found in the structural members of buildings, it being taken for granted from this point onward that continuous structures should be erected with reinforcement designed to provide such static resistance as the continuous nature of the member demands.

A few concrete buildings have been erected in which the several structural members have been molded on the ground and erected and set in place in the same manner in which timber and steel work is handled. In the majority of cases, however, it has been the endeavor to secure a monolithic structure, and this theoretically monolithic nature has been one of the points much advertised as a great advantage inhering in concrete work. This very condition of perfect continuity has some minor advantages. Sound and vibration are transmitted much better than in a less rigid structure, but the greater mass and the inherent nature of the propagating medium tend to absorb the vibrations so that at least one of these disadvantages is usually turned to a favorable property. A much more important point for consideration in this connection, is the fact that

*A paper before the National Association of Cement Users.

in structures composed of discrete members, innumerable joints naturally exist at which expansion and slight changes of position from deformation, can take place without endangering the structure, because brackets and other devices are provided to allow of such conditions. The first designers in reinforced concrete were so imbued with the ideas of the older types of structures that they thought of the several members of a concrete building as practically identical with those of all other types. The first regulations covering reinforced concrete work adopted by municipalities thus viewed this point as is shown by their specifying that a factor of one-eighth should be used in the design of beams, girders and slabs. Very soon, however, trouble arose in buildings executed in accordance with such designs, which were being loaded to anything approaching their theoretically safe carrying capacity. Cracks occurred in the floor surface at the ends of beams and girders and slabs cracked away from beams in the same manner. These cracks were often ascribed to shrinkage or settlement or other factor, but in many cases were the necessary result of natural deformations of the structure. They showed that the same thing took place in concrete beams as happened in any other kind, but that allowance had not been made for such action. The next step was to require special reinforcement over points of support, to correct this trouble, and in order to secure some hypothesis for determining the amount to be used, advantage was taken of an observed fact that the factor one-eighth could be reduced to one-tenth for various reasons for moments at the centers of beams. Since one-fortieth measures the difference between this factor and the theoretical total, the amount of reinforcement thus determined was specified at the points in question.

When thus reinforced, a continuous beam possesses partial restraint at the ends. If a homogeneous beam of constant section be considered and one with a moment of inertia correspondingly less than a beam designed to carry the same total load when supported without restraint, it will be found that the theoretical slope of the neutral axis at the support is to be measured by the figure 7 as compared with 10 for a free beam. Such a slope would theoretically open a considerable crack at the top of almost any beam. Obviously if this condition existed, the steel designed to carry an amount of moment measured only by the factor 1-40 and at a stress equal to that of the steel near the bottom at the center, would actually be stretched much more than such a stress would deform it, and would consequently be carrying more than is above considered, with a correspondingly somewhat smaller slope of the beam. In a reinforced concrete girder, however, the moment of inertia is not constant throughout, and consequently the slope would probably be fully as great as first described above, even though the reinforcement was stressed beyond the permissible amount. If this actual stress happened to exceed the elastic limit of the top reinforcement, as may easily happen, a permanent deflection would result in the top of the beam. Furthermore, a similar permanent set would have taken place in the concrete on the under side, below the crack, because of the high compression which would have taken place in the concrete. A repetition of the load would be likely to increase the first increment of deformation, and this increase would continue until a slope had been permanently secured, beyond which the added deflections caused by ordinary loading would not cause stresses above the elastic limit of either the steel or the concrete.

But in order to attain this state of affairs, the stress conditions in the beam may have far exceeded safe limits, and many observations have shown this to have actually happened in more than one building.

The dangers incident to such tension cracks adjacent to points of support are numerous. They occur where the shear in the beam is a maximum and unless ample reinforcement is introduced to resist these latter stresses (as is really very rarely done) their unit values will run up far beyond limits usually considered safe. These initial tension cracks also serve as starters for others which tend to occur from the diagonal principal tensile stresses. Cracks of the latter variety are apt to develop suddenly, producing destructive failure in test specimens, and there is no reason to suppose that more immunity would be found to inhere in actual structures, should the load ever reach a critical value. With the formation of such cracks, the zone of compression is obviously restricted to the uncracked part of the concrete, and if the crack is driven across the initial position of the neutral axis, the unit stresses in the extreme concrete layer must exceed permissible, safe

ones. Then, too, in the cracked condition, the concrete can have no tensile value, and while this element is usually ignored in design work, its practical effect is well known to those who have made tests of beams and who have studied the subject of diagonal tension to any great extent. With a cracked condition, moreover, there is almost infinitely more opportunity for the reinforcing steel to be attacked by rust, with possible further incidental troubles. The few laboratory tests concerning this matter which have been made, principally in Germany, are inconclusive, and are best to be interpreted by the facts of actual experience, wherein rust has been discovered in connection with very fine cracks, when the metal was not covered with more than three-fourths of an inch of concrete, as stated in a very late issue of a technical magazine.

The more steel is supplied over the points of support (up to the theoretical necessary limit), the more are the above mentioned destructive tendencies reduced. Of course, with perfect restraint, twice as much reinforcement is required over supports as at the centers of beams. It is needless to state that this condition is almost never attainable at end bearings, although it is often closely approached at intermediate ones in large buildings, especially on the lower floors, where heavy column loads give excellent stability to the members meeting at those points. With regard to the latter point, a column 16 inches square and stressed to 300 pounds per square inch for instance, will resist a moment of 28800 foot pounds without developing tension on one side of the base if it acts only with its vertical load. This will be equivalent to that of a uniform live load of 832 pounds per square foot distributed over a panel 20 feet square. Of course such a column, if of any considerable length, would itself be bent to some extent by such a moment. This example tends to show the real action of the reinforcement usually installed and also indicates the necessity of a better form of splice on longitudinal rods in columns, than a piece of gas pipe slipped over the ends. On the upper floors, however, and in wall columns, special reinforcement must be installed if any real restraint is to be secured above that afforded by the tensile strength of the concrete itself.

The same general reasoning applies to slender columns which may be flexed by beams supported by them as has been given for beams with deficient reverse moment reinforcement. This is particularly true with regard to the columns which have been designed to support long span, heavy roof girders. There is no reason why such a combination cannot be analyzed, even as to the effect of unequal settlement, and the writer invariably makes an analysis of such designs, on the assumptions of rigid restraint at foundations, no shortening of the girder through its deflection, and ignoring the bending effect on the column produced by the slight eccentricity of its load from the same cause. The problem then becomes one simply of a continuous beam over three spans with restrained ends, the parts having different moments of inertia. The solution is not particularly difficult, and by simple graphical methods the proper arrangement may be readily determined. It is usually found that more column steel is required than had been expected and that less end restraint of the main girders is secured than is often allowed.

Partial loads on continuous members over hinged supports give maximum positive and negative moment curves different from those for full uniform load. In a monolithic structure no supports are as flexible as a hinge should be and consequently the full values thus obtained can be modified with perfect safety. A considerable study given to the subject seems to show that the amount of steel indicated by the use of 1-12 in computing the moment of a continuous uniform load, placed at both the top and the bottom of a continuous member is ample. Its proper distribution may be closely approximated by dividing the axis of a parabola into thirds and making the top and bottom steel overlap the amount shown by the center third. For various reasons, too, it is wise to run at least one rod from end to end of a continuous member along its bottom, in spite of the theoretical wastefulness involved. Some engineers also run one throughout along the top, and this is absolutely essential on short spans adjacent to longer ones. In such cases a careful analysis should always be made. Even in the floors of ordinary warehouses, deflection experiments show considerable upward movement when alternate bays are loaded. Excessive loads, located in this way, might easily cause dangerous cracking in the unloaded bays, while the loaded ones were perfectly safe.

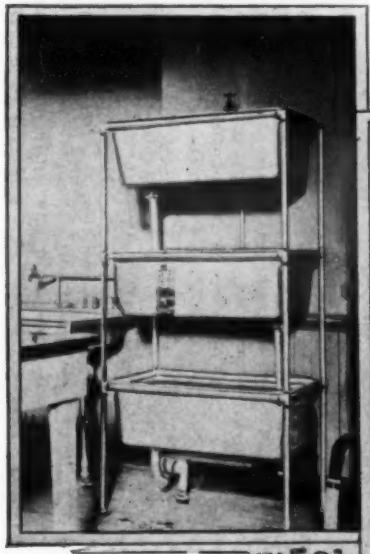
In a monolithic structure, secondary

stresses from local settlement, shrinkage during setting and changes of temperature are of much greater moment than in buildings constructed of discrete members with numerous joints. If local settlement takes place in a column, for instance, there is a tendency to produce worse cracking at points adjacent to the neighboring columns when the beams and girders are reinforced as simply supported ones, than when they are treated as continuous. Much more elasticity is secured, a better distribution of stress and consequent diminished likelihood of annoying cracking. Furthermore, when cracking does occur, it is less likely to be of a dangerous character than when the members are reinforced as simply supported ones.

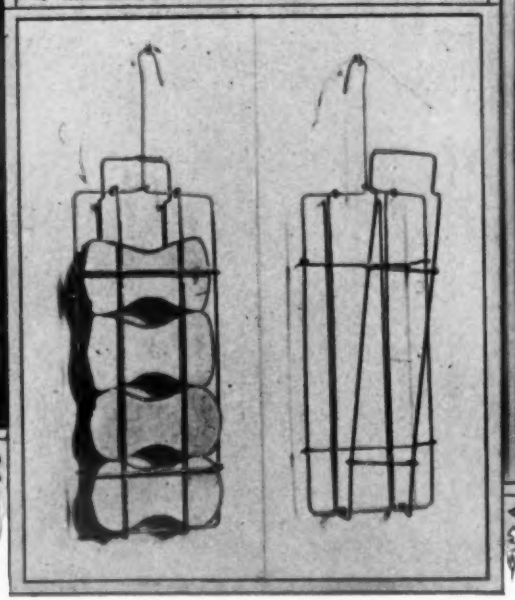
The shrinkage which takes place from setting is not usually sufficient to cause any trouble, except at such points as connections between floor slabs and the deep ribs of girders and beams, unless very large long or deep stretches of work are placed in a single operation. Great care should be taken in the arrangement of the reinforcement at such points, the continuous type being altogether best even for floor slabs. It may not be out of place to remark at this point that the actual effective width of flange in such T-beams is probably not nearly as wide as is assumed by many engineers. Care should be exercised in the design of the reinforcement of heavy floor girders to see that enough reinforcement runs through the flanges of the T, across the top, to provide for the secondary bending stresses which are developed by the shearing stresses close to the stem. This condition is usually overlooked in connection with the members which run parallel with the floor slab reinforcement. Members running in the opposite direction secure ample assistance from the regular slab rods. Also, that in continuous members, for ordinary loads, the neutral axis is so high in the vicinity of points of support that little is to be feared from possible compression failures at such points unless the compression stress condition within the zone is aggravated by the approach of a diagonal tension failure. The latter is the one shown indirectly as the cause of rupture in all the tests of continuous members with which the writer is acquainted, and to obviate which special care should be exercised in design work. That the computed compressive stresses run very high shows either that the confined condition adjacent to points of support makes such stresses possible, or that wrong methods have been used in their calculation, or wrong assumptions made on which to base computations. All these are probably true. In designing the reinforcement for such continuous members, care should, therefore, be exercised to provide as ample steel as possible to assist the concrete in resisting compression, shearing and diagonal tensile stresses. Perhaps it is somewhat beside the point to state here that all tests of continuous members show great deficiency of the original concrete to withstand the developed diagonal tensile stresses without the addition of considerable steel in the form of stirrups or other heavier rods, either vertical or inclined, or both, and properly anchored at the ends. But the reinforcement for few buildings is designed with such an amount of reinforcement at those points, and if continuous members are to be considered at all, the present practice is open to considerable improvement. As was said before, because structures remain standing is no criterion of their proper design and construction. The condition of numerous country highway bridges is a notorious example of the existence and continued use of sometimes actually dangerous structures.

Change of temperature is a potent cause of innumerable, unknowable, secondary stresses in many structures. In such buildings as tanks and long walls in which cracks are inadmissible, absolute continuity of reinforcement is essential. Nothing further need be said concerning such structures, except that it is not usually advisable to reinforce retaining walls so as to prevent cracking. Even where water tightness is necessary it seems wisest usually to undertake to secure it by the employment of a watertight expansion joint, together with a waterproofing by some method in connection with the portions of wall between joints. To be sure, in one instance of a reinforced concrete face for a high rockfill dam in the Sierra Nevada Mountains, a recommendation was made to carefully reinforce areas aggregating approximately 20,000 square feet, rather than to make use of waterproof expansion joints under hydraulic heads over one hundred feet high.

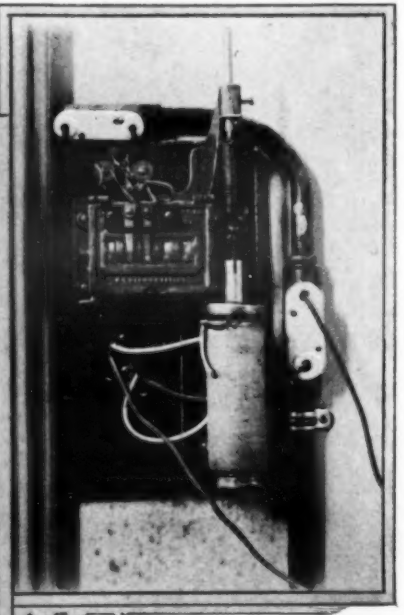
In buildings of relatively small dimensions as to ground area, no expansion or rather contraction joints are necessary, especially in the upper



Briquette Trays.



Briquette Racks.



Automatic Counter and Stop Motion on Brick Abrasion Machine.

I. CITY ENGINEER'S LABORATORY, ROCHESTER, N. Y.

stories. In long buildings, some joints may be deemed advisable in order to obviate the heavy tensile secondary stresses which must sometimes exist and which show themselves by cracks, sometimes at unsightly and occasionally at dangerous points. In small buildings the employment of numerous distributing rods through the floors at right angles to the regular carrying rods will usually be sufficient as far as the floors themselves are concerned. Around window and door openings special reinforcement should always be provided to prevent the formation of the cracks which often start at all four corners and extend for short distances into the walls. Roofs are subject to extraordinary changes of temperature in their several parts, and need the greatest of care in the design of their reinforcements, especially when the slabs are treated as the flanges of long span roof girders.

In larger buildings, clean out joints may be installed and can best be placed at the centers of panels by providing cantilever beams as girders half a span in length on each side. Such joints should always be covered with an elastic water-proof coating to shed the water falling on the floors in case of fire.

This discussion has been mainly on the subject of the prevention of cracks, a series of prescriptions for the overcoming of certain symptoms. While simple tension cracks on the bottom of beams at their centers are not usually at all dangerous, since they commonly develop at comparatively low steel stresses, still, the owner is not aware of this fact and is not readily convinced that there is no real defect when his building commences to crack. He wants a perfect structure and is entitled to receive it, particularly when possible danger of the formation of rust exists when cracks have formed, and more particularly when a slightly different arrangement of reinforcement would entirely eliminate the fancied or real trouble in question.

Logic thus seems to dictate that all structures which are at all monolithic in character, thus having members continuous over supports or through floor levels, should have their reinforcement so designed and placed as to make them act under all load conditions as their original monolithic nature would make them start to act.

THE TESTING LABORATORY OF THE CITY ENGINEER OF ROCHESTER, N. Y.

The following description of the testing laboratory connected with the office of the city engineer of Rochester, N. Y., and the accompanying photographs are taken from the latest report of City Engineer E. A. Fisher, to whom we are indebted for the permission to use them.

The laboratory is located on the ground floor of the Municipal Building, in five rooms at the rear and in a section of the basement, which is used for brick testing. Joseph E. Putnam, electrical assistant engineer, is in charge of the laboratory, and Ruden W. Post is his assistant.

The southerly room, about 23 feet square, is used for testing cements. It is provided with a complete equipment for making all tests of cement required by the city specifications. The tanks in which the briquettes are stored prior to testing for tensile strength are a set of three standard porcelain sinks, 12 inches deep, 34 inches wide and 18 inches thick. They are shown on Plate I. Attention is called to the wire frames holding the briquettes suspended in the water from a rod across the top of the sinks. These frames afford a very convenient method of handling the briquettes. They are shown on Plate I also. This apparatus was designed by Messrs. Putnam and Post.

The room next north, about 13x24 feet, is used as a chemical laboratory for testing asphalt. This room is equipped with three fume chambers from which the air is drawn by a Sturtevant exhauster, driven by a small motor. This laboratory and the cement laboratory have tables, with plate glass tops, resting on a number of thicknesses of black building paper. This glass gives a smooth surface, easy to clean. Much of the work consists in testing mixtures that are being used in the asphalt pavements. The equipment for this purpose is very complete, the specifications for which were furnished by Prof. A. W. Dow, consulting chemical engineer, of New York City. This room is shown on Plate II.

Adjacent to this room, on the easterly side, is the photometer room, for testing the candle power of gas. This room is equipped with a 100-inch Sugg-Lethby Standard Gas Testing Photometer made

II. CITY ENGINEER'S LABORATORY, ROCHESTER, N. Y.—CHEMICAL ROOM.

by the American Meter Company. Tests of the illuminating value of the city gas are frequently made. Plate III shows the photometer equipment.

The room at the northwest corner of the building is fitted up with a Starr lathe complete with gear cutting attachment, driven by a small motor. The necessary instruments for electricity tests are also kept in this room.

An additional room easterly of the last mentioned is used for records of the lamp department, and contains maps showing the location of all street lamps, also card indexes giving the exact location of said lamps.

There is also installed in the basement a Riehle Bros. steel rattler for testing paving brick. This rattler is driven by a 10-horse power motor. In order to watch the operation of the rattler, and know that the exact revolutions prescribed for a test are actually made, Mr. Putnam devised an indicator, located in the cement testing room upstairs and connected by electric wires. This counter is such as is used on printing presses. A switch is opened and closed by the rattler, the electric impulses working the counter through the action of the solenoid. The test is 1,800 revolutions, and the apparatus is so arranged as to automatically shut off the current when this number of revolutions has been made. The apparatus is shown in Plate I on the right. The whole arrangement of rooms and apparatus is most complete. It has been in constant use since its completion, and has resulted in raising the standard of the materials used in public work.

TREATMENT OF CONCRETE SURFACES.*

By E. B. Green, Architect, Buffalo, N. Y.

I need not tell you that the architect's interest in the uses of cement is second only to your own. But while you are enabled to give your entire time and thought to cement construction, his interests are necessarily divided among many methods of construction and various materials.

When you think of the various things that enter into the construction of a modern building, of which he must have more than a passing knowledge, and to no one of which must he give an undue weight, it will appeal to you that the interest which he takes in concrete construction must be somewhat less than yours.

He cannot pretend to become an expert in any one method of construction, and it therefore gives us pleasure and much profit to become acquainted and be surrounded with those who devote their efforts and intellectual forces to one or two channels in the art of building.

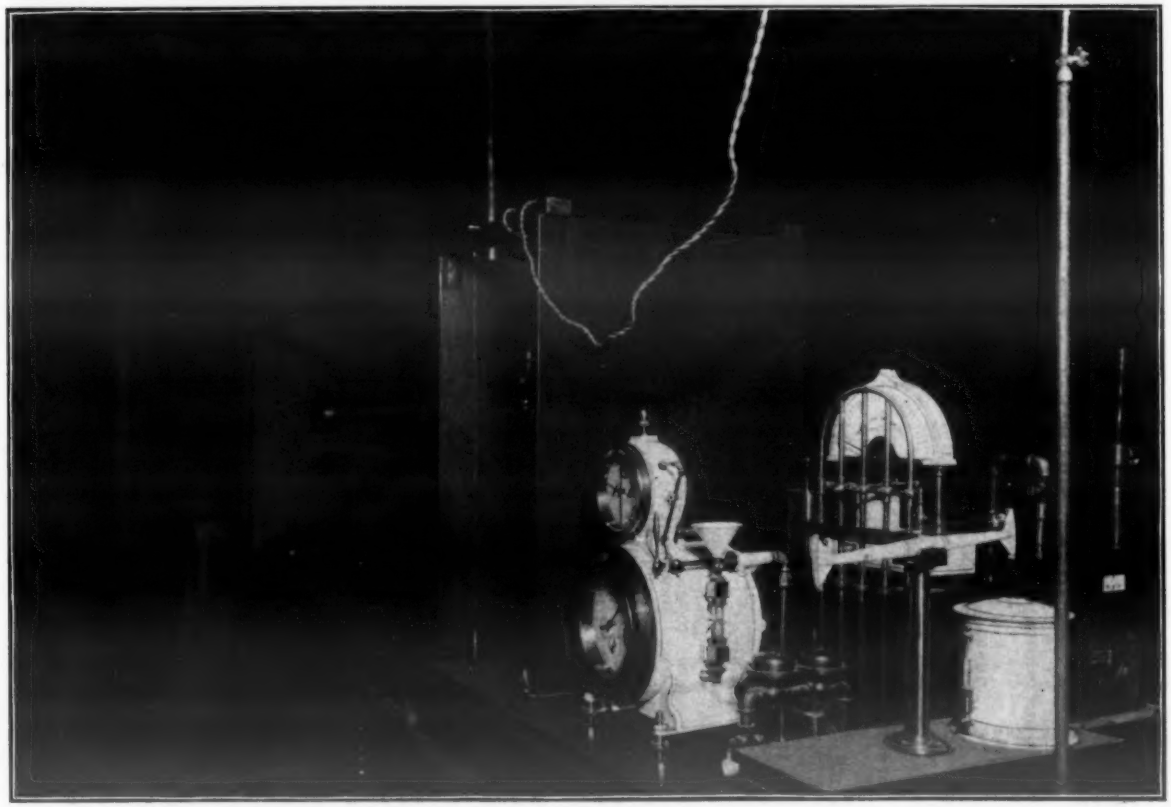
Architects, as a class, are conservative, and our energies and thoughts are given to the designing, to the form of the structure. The carrying out of the work is best left to those equipped for that special purpose. We, of course, must be conversant with the various methods of fabricating the material in order to design the structure properly.

As yet, our profession rests primarily upon that of form, scale and the disposition of mass and voids (which is the design) more than on the methods or materials of construction.

I may say that all architects are looking forward to the study of this question with the keenest interest. We have become familiar with the structural side, and are constantly urged to take up the esthetic side of the use of concrete. It holds forth tremendous possibilities, and the day will be a happy one when you have devised methods for the use of cement which will make it possible to do away with wood construction in all city buildings. Can we realize what it would mean to have all our buildings in this city fireproof—the lessening of taxation, to say nothing of the danger from fire?

To tell you the interest which the architects are taking in the subject of concrete and reinforced concrete, I will say that nearly two days out of the four allotted to the annual meeting of the American Institute of Architects were devoted to the discussion of concrete, and we had some pretty stirring times and a good deal of ripping up the back of old methods, and it did us all a lot of good. Still the consensus of opinion at the end seemed to be one of uncertainty and caution—we must be careful. The methods are not yet on the same basis as masonry construction and the manufacture of steel, for instance. It is diffi-

*Paper before the National Association of Cement Users.



III. CITY ENGINEER'S LABORATORY, ROCHESTER, N. Y.—PHOTOMETER EQUIPMENT.

cult, if not impossible, to make a test of the work before it is completed, but if it were possible to fabricate concrete under known conditions and under cover, I think the architects would be still more enthusiastic and ready to take the question up on its esthetic side.

The question of weather, the proper mixing of the material and of the forms and the reinforcement, mean so much that under the very best conditions the contractor has a difficult problem to get his labor to do as he directs.

A report was read at that convention by the chairman of the Committee on Applied Arts and Sciences, Mr. Irving K. Pond of Chicago; Messrs. Claude Bragdon, Elmer Gray, Charles Z. Klander and Bertram G. Goodhue being on the committee. This report defines so well the position of the architect in regard to the use of concrete that I have chosen to read it as giving you an authorized idea of the architect's standpoint.

Although the exact relationship existing between concrete and steel reinforcement under a given condition is yet to be accurately determined, and the structural use of reinforced concrete is yet to be reduced to an exact science, and although the manipulation of concrete and its application to structural uses has not as yet become an art, yet the fact that in its use and treatment there are immense scientific and esthetic possibilities, brings the subject of reinforced concrete well within the field of study of this committee, especially at this time, when the general topics of steel structure and concrete reinforcement are before the institute for discussion. It is essential throughout such discussion to keep clearly in mind the true and abiding status of architecture and the architect. The architect is not a mechanical fabricator of mathematical diagrams. His highest concern is with the ideal, and his first sketch should present an idea, an idea which is conceived in beauty. The past has demonstrated that architecture, as the expression of the ideal, can materialize in but one or the other of two great manners: that of the articulated structure, unit added to unit, and that of the plastic mass. The most noble development in the first manner is in the architecture of masonry (brick or stone) and this development has reached its logical limit; in no way, except it may be in mere size, its least noble attribute, is it to be excelled.

And now comes the ghost of what might have been, and calls for an incarnation, feeling (if a giant can feel) that in reinforced concrete science is preparing a way which can be vivified with the spirit of art. If this feeling is substantiated, to the architect is opened up a new range of possibilities. The architect becomes in a sense a sculptor, a molder of monumental mass; not the fantastic figure who, at first with sharply insistent blows and then with infinite persuasive tappings, releases the form imprisoned in the block, but a creative constructor who builds up his ideal and shapes it by the irresistible though tender molding of mass and form.

The masonry-clad steel structure of today is an architectural anomaly, representing as it does rather a branch of engineering than of architecture; and it is doubtful if any treatment of the encrusting material, be it brick, stone or terra cotta, can make the structure architecturally interesting as compared, for instance, with the interest which attaches to a well designed brick cottage or stable, even. The steel structure, however, will continue to occupy its own domain. But the call of concrete is heard inviting architecture to occupy an as yet undeveloped territory.

Though the use of concrete goes back to antiquity, plastic architecture would seem to be in the veriest infancy, and would seem also to be asking the genius of this age to give it perfect expression and make it worthy to stand with the architecture of the past and yet-to-come. Though the past be examined for precedent, little will be found. Rome used concrete in bulk—but undeniable evidence of a scientific use of the material is wanting. Rome employed masonry in bulk—but again evidence of a scientific use is wanting. Rome applied superficially the arts of other times and countries, but of itself left to posterity only monuments expressive of a highly tempermental force, breathing little or nothing of spirituality. The Spanish missions were built with a rare feeling for mass and light and shade; but feeling swayed and science did not guide. With the science of today to guide, and the art experience of the past to illuminate, into what logical, noble and beautiful forms should not concrete shape itself, to the end of an enduring, spiritualized architecture?

In this study your committee has taken no cognizance of the concrete block as a structural possibility, believing that such blocks, as well as the terra cotta used in the same manner, are mere imitations of stone, and when used after the manner of stone, are impossible in the architecture of sentiment, and, like all imitations of one material in another, are inimical to art.

The possibilities, even the esthetic possibilities, within the range of reinforced concrete construction, can hardly be over-estimated. Little beyond the introductory chapter has been written in the history of reinforced concrete, and every advance in the science of its manufacture and use will signal an advance along the line of artistic application.

Except in well defined types, designed to serve certain well defined uses, it is impracticable so to carry masonry construction beyond and behind the facade as to result in a homogeneous structure—wanting which architecture becomes but a hollow sound. The architecture of a reinforced plastic material may and logically will express itself throughout the entire structure to the remotest core. The unity, the truth, the harmony of the whole may in every part be manifested. Therefore, again the possibilities inherent in concrete present themselves alluringly

to the architect to whom the art means as much as does the science of building.

The architectural brain is not so congested by the weight of pregnant thought that at a blow a Minerva shall issue forth, full fledged and full armed. That is not the history of the evolution of an architectural style. It will take time and struggle and developed artistic perceptions in this, as in former cases, to reveal the possibilities of beautiful and of monumental design.

Yet it is possible that in this, as in other ages, commercialism, itself so devoid of esthetic tendencies, will pave the way to the realization of an aesthetic ideal. A material which holds in itself the qualifications for commercial use will in that very use reveal its esthetic possibilities. No material which puts into the hand of the architect power to reduce permanent mass and form, and add the enrichment of light and shade, color and texture, will be ignored long when science has made its use commercially possible. It would then seemingly remain only for science to demonstrate the practical value of reinforced concrete, in respect to its physical properties, and art must unfold whatever it holds of beauty.

The steel skeleton developed from commercial necessity, and to clothe and perfect that skeleton, the architect, naturally, used whatever means lay at his command; stone, brick, terra cotta and metal were called into requisition. To clothe the skeleton in one or another or all of these materials became a fixed habit with the architect. So that when concrete came into use not only was it ignored as a possible clothing for steel, but when the skeleton of reinforced concrete was set up, it was itself clothed after the existing fashion for steel. Such is the fatal force of habit. Granting to concrete the qualities ascribed to it, that it is fireproof, that it may be rendered moisture proof, that once in place it is not affected by atmospheric and climatic conditions, that it can be permanently colored, can be molded and chiseled, that it can be formed in place and need not be applied piecemeal—what better material could be sought for clothing the steel skeleton? And why the need of any cloak at all to such material, when it has been treated with any manner of decency or respect by the designer? So esthetically there would seem to be unlimited possibilities in reinforced concrete.

Although it has not been its purpose to study that especial phase, it seems to your committee that the esthetic possibilities inherent in terra cotta and faience as covering materials for the steel skeleton have not as yet been in the highest degree realized, while, as stated before, concrete as a possible covering has been ignored. Simultaneously with their development in the field already assigned to them, it is not inconceivable that ornamental terra cotta and tile beautiful in color and texture, and also sculptured stone, will be called upon to embellish and distinguish, though not in any manner to clothe or conceal the concrete structure. The presence of these materials may be needed as a saving grace in these early days of design in concrete, to save the designers from a too brutal conception of the forms they deem the material must necessarily take. There is an unfortunate though marked tendency now in what should be a refined and restrained domestic architecture to shape concrete, and its lath and plaster imitations, into the crude though characteristic forms of the old mission work. It is needless to say that these forms have no meaning outside of their original environment, and would not have existed there but for the exigencies of the case—the crude nature of the materials procurable and the absence of all skilled labor.

But today, with art and science cooperating, it would seem as though architecture were on the verge of an awakening. Commercial architecture with us is beginning to feel the thrill. Abroad, monumental architecture as well is showing signs of a renewed joy in life and structural concrete, both of itself and embellished with richer materials, furnished the new and seemingly adequate medium of architectural expression.

EDITORIAL COMMENT

Increase in Price of Lumber.

The Law Regarding the Pollution of Streams.

Administration of Public Service Commission Statutes.

INCREASE IN PRICE OF LUMBER.

The Forest Service of the United States Department of Agriculture has issued a table showing wholesale prices of various kinds of lumber on the first of January each year since 1886 on the markets of New York, Baltimore, San Francisco, Buffalo, and the Yellow Pine Manufacturers' Association. In New York the increase in price of basswood, yellow poplar, some grades of spruce and white ash common was over 100 per cent., the last named being 122 per cent. Birch, chestnut, cottonwood, hard maple, white oak, yellow poplar common, hemlock and spruce, and white ash, show 58 to 93 per cent. increase, cherry 35 per cent., and white cedar 7 per cent. First and second-grade cherry now costs $105 a thousand, ash $60, white oak $82, yellow poplar $62, and so on down to $22 for hemlock boards and $27 and $28 for cherry and basswood culls. Black walnut costs $115 a thousand in Baltimore, an increase of 28 per cent. since 1889. Redwood costs $35 in San Francisco, an increase of 46 per cent. since 1886. In the Buffalo market white pine costs from $44 for No. 1 barn, rough, to $111 for rough uppers, 4 by 8 inches and up, the percentages of increase since 1887 being from 88 for No. 1 cuts, rough, to 131 for each of the two classes above named. The Yellow Pine Manufacturers' Association market reports show prices of $17.50 for No. 2 common inch boards to $36.75 for A edge-grain flooring, and increases ranging from 30 per cent. for the former to 71 for the latter since 1894.

These facts show that the timber industry must be properly protected and nurtured on the one hand, and they show on the other the growing necessity for other building materials, and suggest the probable rapid increase in the substitution of cement construction for timber, the rapidity of the increase depending only on the retention of the price of cement at a reasonable figure, the supply of cement and the further increase in price of lumber.

The general market for cement is therefore bound to increase in its demands on the manufacturers, so that, while financial flurries may reduce the rate of increase in the demand or even temporarily reverse it, due attention to reserve funds will carry any cement plant through the hard places and keep it in line for the further increase which is bound to come.

The large number of new cement companies, listed in MUNICIPAL ENGINEERING last summer and fall, showed that there would be an attempt by new capital to keep up the supply, but the proportion of these projects which has materialized is thus far quite small, so that it behooves the plants now in existence to get in full readiness for the trade which is practically in sight or only just around the corner.

THE LAW REGARDING THE POLLUTION OF STREAMS.

An addition to the discussion regarding the laws concerning the pollution of streams, which were considered in articles in MUNICIPAL ENGINEERING, vol. xxxiii, pp. 151 and 231, was made at a recent meeting of the Boston Society of Civil Engineers, by attorney Charles F. Choate, Jr., and others, attorneys and engineers, when the subject for the evening was "The Pollution of Waters at Common Law and Under Statutes."

The discussion is reported in the February number of the *Journal of the Association of Engineering Societies*, just issued, and is largely devoted to conditions in Massachusetts, with special reference to the pollution of streams by manufacturing wastes and of salt water by sewage and garbage.

Mr. Choate makes a general statement of the common law governing the matter as formulated in a case involving damages to one riparian owner by the pollution of the stream by manufacturing refuse discharged into it by another riparian owner. He considers the law to be that every riparian owner has the right, as an incident to his ownership of land bordering on a running stream, to have the water come to him in its natural flow unpolluted except by a reasonable use of it by others. The common law was developed in an agricultural country and in the agricultural stage of this country, and there is a tendency to change in the interpretation of the term "reasonable use," which makes variations in the practice of courts in different states, and even in the same state, until the law is crystal-

lized by decisions in the highest courts of the state, and there is also opportunity for variation in the United States district and circuit courts from the decisions in the state courts of the same territory.

Mr. Choate calls attention to some of the differences with respect to trades wastes, showing that the importance of the industry sometimes causes a leaning in its favor, which he deprecates, because the slightest deviation from the fundamental principle of the common law on the subject opens the way to other departures until shortly nothing is left of the principle.

With reference to the right of municipalities to drain into the streams, Mr. Choate states that the principle seems to be established beyond any question that the drainage of streets in towns or cities in a natural watershed of a stream may be turned into that running stream without anyone having the right to stop it or to recover damage for it. The mere fact that the discharge is quicker and perhaps greater is not a violation of the rights of any riparian owner below. But the right to discharge the sewage of a city into a stream is quite a different matter. Mr. Choate shows from Massachusetts decisions that a riparian owner injured by the discharge of sewage into a stream by a city above him cannot recover damages for the injury, but he holds the opinion that such riparian owner can, in a court of equity, obtain an injunction to prevent the continuance of the pollution, unless the pollution has continued twenty years or unless it is authorized by a special statute.

A circuit court in Indiana held that the city's sewage was a part of the city's drainage, and so its discharge into the stream could not be enjoined, but this decision has never been passed upon by the higher courts of the state and might not be sustained by them.

With reference to statute law, Mr. Choate evidently holds the opinion that the state may authorize the pollution of streams, but the passage of such a statute must involve the payment of damages for harm done.

Undoubtedly effect can be given to the principles of the common law by means of statutes regulating the discharge of wastes of all kinds into streams as well as to nullify their effect by special statutes. To give definiteness to the situation, therefore, it is most desirable that statutes based upon proper principles should be passed in all states, and particularly in those states whose supplies of pure surface water from mountainous or other unsettled districts are small or altogether lacking. Massachusetts, New York, Pennsylvania, Ohio, Minnesota, are the principal states which have made progress on this line, and the first four have carried their regulation of streams to an extent which promises good results. Their laws will serve to put other states in the right way if they are used as examples, although each state must make its own modifications to suit conditions and customs within its territory.

ADMINISTRATION OF PUBLIC SERVICE COMMISSION STATUTES.

The new public service commission statute of Wisconsin takes the form of a reference of the control of gas, electricity and water development companies to the State Railroad Commission, which has been working upon the railroads, steam and electric, of the state for a number of years. It prescribes the duties of these classes of corporations and of the state commission with reference to them.

A large part of the value of the law is found in the provisions which bring about a reasonable publicity of the operations of the companies. The freedom of the commission in the establishment of standards is a feature of the law almost equally valuable.

The present commission seems to be proceeding upon the theory that its duties are to meet the present conditions and lead in the future development of the industries put under their care. They are putting into the study of their new charges the same intelligence, honesty and efficiency which has characterized their study of the railroads, and are the more disposed to counsel with the operators of these plants because they are so much more independent and operate under such a variety of conditions.

The gas and electric light companies are receiving special attention at this time, and in conformity with the commission's desire to act with proper consideration of the companies' side as well as that of the consumers, a series of public conferences is being held. One held on March 3 was devoted to gas standards. After several addresses by experts upon the methods used elsewhere and the apparatus and standards having the highest authority, the conditions in Wisconsin were taken up and much valuable information was presented.

The discussion over the standard calorific value of gas was very spirited. The chairman of the commission proposed a monthly average of 600 B.t.u. per cubic foot, with a minimum of 550 at any time. Milwaukee was reported as operating at 600 to 635, while the smaller companies considered the average proposed to be out of reach, one company stating that it should not be more than 580 B.t.u. The

standard should be gross value to eliminate the question of efficiency of the apparatus used for burning the gas.

Recommendations regarding pressure varied from 1½ inches of water to the maximum necessary to reach outlying districts.

Standards of accuracy of meters were also considered, variations of 2 per cent. from absolute accuracy being stated as common practice.

The next conference will be upon electrical standards.

The educative value of these meetings between the practical operators of plants and the experts employed by the state or brought to the meetings to make addresses is very great, and a cordiality of feeling and unity of purpose should be developed which will make the work of the commission easier, because it will show the managers of companies the scientific basis for its work and its intention to do exact justice to all. The reports of further conferences and the resultant code of rules and regulations adopted by the commission will be awaited with interest.

THE QUESTION DEPARTMENT

Residential Septic Tanks.

Have you published any articles or series of articles within the last few years regarding septic tank sewage disposal systems as applied to country residences? If you can give us any further information or refer us to any other articles on this subject, we should greatly appreciate your doing so.

A. H. CO., Minneapolis, Minn.

There are two good articles on this subject in MUNICIPAL ENGINEERING, vol. xxiii, pp. 355 and 357, which give quite full descriptions of septic tanks for private residences. Such books as Waring's "How to Drain a House" ($1.25) give descriptions of other methods of purifying sewage from isolated houses.

Magazine Devoted to Hydraulic Science.

Will you please inform us where we can get a magazine which has as its primary object the development of hydraulic science? O. A. C., Corvallis, Ore.

The writer knows of no such magazine. The Proceedings of the American Society of Civil Engineers probably contain the most valuable contributions to hydraulics of modern times. The engineering journals, particularly those devoting large space to sanitary, municipal and power engineering, contain reports of all the new contributions to the science, but no one of them makes hydraulics its primary object.

Raising Old Stand Pipe.

We have a stand pipe that is standing in a low place in town. We are somewhat limited in pressure for domestic purposes and are now thinking of having it jacked up about 25 feet. Would this be practicable to do? Say we would enlarge the foundation with reinforced concrete to make it strong enough to carry the extra foundation up 25 feet. Could you refer me to some one who could do this work? We can't build on top of our stand pipe on account of the iron plates being too light.

H. K., Emmetsburg, Ia.

It should be very easy to elevate the stand pipe in the manner proposed, unless some difficulty arises about the condition of the bottom, and this could probably be overcome by adding a new bottom if found necessary. A steel tower standing on four legs or a brick or concrete wall could be used for the support of the tank in its new position, and new foundation put in for this new support to correspond.

Engineers' and contractors' names will be found in the "Business Directory" published in each number of MUNICIPAL ENGINEERING, under the headings "Civil Engineers," "Consulting Engineers," "Contractors." The individuals and firms named are competent to design or supervise the work or to do it.

Lists of Gas Plants and Water Softening and Purification Stations.

Will you kindly advise where I can obtain a list of gas plants and water softening and purification stations in the Middle West or the United States?

Hydrated lime can be used to an advantage in a great many of these plants, and as manufacturers we desire to direct their attention to our high calcium product. J. B. G., Chicago, Ill.

Brown's Directory of Gas Plants ($5.00) contains a complete list of the

gas plants of the country. In the "Manual of American Waterworks" ($3) will be found descriptions of public water supply plants which would tell what systems have water-softening and purification plants, but there are so many more of these plants in connection with factories, railroads, etc., that this would give only a very small portion of the list. The manufacturers of the water softening apparatus are the only source of such information known to the writer.

Books on Operation of Water and Light Plants.

I would be pleased to have list of publications or works bearing on the handling of municipal light and water plants.
J. T. RYAN,
Chairman of the Finance Com.,
Kingfisher, Okla.

As regards the operation of water plants, the following books give something regarding details of management in their respective fields. They are arranged in the order of their probable value to our correspondent for his purposes:

Goodell's "Waterworks for Small Cities and Towns" ($2);

Turneaure's "Public Water Supplies" ($5);

Folwell's "Water Supply Engineering" ($4);

Hazen's "Filtration of Public Water Supplies" ($3);

Fuertes's "Water Filtration Works" ($3.50);

Mason's "Water Supply" ($5);

Hill's "Public Water Supplies" ($3).

The best guide on methods of keeping records and accounts is the "American Waterworks Standard Bookkeeping System," which was devised from a study and combination of the best forms in use and their adaptation to the conditions met with in most waterworks offices.

Regarding electric lighting, perhaps the best book is Crocker's "Electric Lighting," which is in two volumes, the first on the generating plant ($3) and the second on the distributing system and lamps ($3).

Cooling Attachment for Gas Engine.

Can you kindly refer me to some one who is building a cooling attachment for internal combustion engines? I understand there is such an engine built.
H. K., Emmetsburg, Ia.

Many of the makers of gas and gasoline engines attach coolers. Following are the names of a few:

Hart-Parr Co., Charles City, Ia., oil-cooled.

Gade Bros. Mfg. Co., Iowa Falls, Ia., air-cooled.

Gilson Mfg. Co., Port Washington, Wis., air-cooled.

Model Gas Engine Works, Peru, Ind., air and water-cooled automobile engine.

Speed Changing Pulley Co., Indianapolis, Ind., air-cooled automobile engine.

Automobile engines in general have air, oil or water-cooling attachments.

Book on Transition Curves.

I would like to have a book on transition curves. H. F., Aurora, Ind.

Following are some of the books giving more or less treatment of transition curves:

Crandall's "The Transition Curve" ($1.50), by offsets and by deflection angles.

Howard's "The Transition Curve Field Book" ($1.50), practically a cubic parabola.

Searles's "The Railroad Spiral" ($1.50).

The following devote a few pages each to the subject:

Andrews's "Hand-book for Street Railway Engineers" ($1.25.

Nagle's "Field Manual for Railroad Engineers" ($3).

Where to Get Standard Rattler for Paving Brick Tests.

Where can I purchase a standard rattler for testing paving brick, as recommended by the National Brickmakers?
B. E. BRIGGS, City Engineer,
Erie, Pa.

There is no authorized manufacturer of the standard rattler specified for abrasion tests by the National Brick Manufacturers' Association. The Luce Engineering Co., St. Louis, Mo., is said to put the standard rattler together on order, but probably a local machine shop could put one up at less expense on account of the saving in freight. Riehle Bros., Philadelphia, also supply them.

The specification on which it should be built, in addition to the usual description of a rattler for cleaning castings, is as follows:

The standard machine shall be 28 inches in diameter and 20 inches in length, measured inside the rattling chamber. The barrel may be driven by trunnions at one or both ends or by rollers underneath, but in no case shall a shaft pass through the rattler chamber. The cross-section of the barrel shall be a regular polygon having 14 sides. The heads shall be composed of gray cast iron, not chilled nor case-hardened. The staves shall preferably be composed of steel plates, as cast iron peans and ultimately breaks under the wearing action of the inside. There shall be a space of one-fourth of an inch between the staves for the escape of the dust and small pieces of waste.

If the exact dimensions stated are not obtainable, the specification permits variation in diameter of rattler between 26 and 30 inches and in length from 18 to 24 inches, if the dimensions are clearly stated in reports of tests, and permits the use of long rattlers if they are cut up into sections of proper length by the insertion of an iron diaphragm. With the same requirement regarding reports, 12 to 16 staves may be used with openings from one-eighth to three-eighths inch between them, if the standard cannot be secured.

The speed of revolution must be between 28 and 30 revolutions a minute, and the belt power must be sufficient to give this speed whether the rattler is empty or charged.

Meter Rates in Small Waterworks Using Pumps.

Can you furnish a list of a few small cities and incorporated villages that are using steam or water power, or both, for pumping their water supply, and are using meters to measure the number of gallons used by consumers, and what price is being charged per 100 or 1,000 gallons used, and minimum rate? I am seeking information as to what would be a fair rating where meters are used.

I am aware that conditions in different locations might vary, and what would be considered a fair rating in a certain town or village might not be applied to all alike; but would like some information as to what other small towns and cities are doing along this line.

B. E. M., Newman, N. Y.

The "Manual of American Waterworks" ($3) will give considerable information along this line.

In certain New York towns the following conditions obtained in 1897:

Ardsley, population 220; consumption, 3,000 gallons a day; 25 taps, all metered; rate, 50 cents per 1,000 gallons; private ownership.

Cambridge, population 1,598; pumping capacity, 480,000 gallons; meters being introduced as rapidly as possible; rate, 50 cents per 1,000 gallons; private ownership.

Cape Vincent, population 1,324; consumption, 25,000 gallons; has no meters, but can compel their use; rate, 50 cents per 1,000 gallons; municipal ownership.

Chatham, population 1,912; pumping capacity, 1,000,000 gallons; has no meters, but gives a rate of 15 to 40 cents; private ownership.

Hamilton, population 1,744; consumption, 30,000 gallons; over half metered; rate, 40 cents; municipal ownership.

Hillburn, population 900; pumping capacity in summer, 720,000 gallons; has few meters, but can compel their use; rate, 40 cents; private ownership.

Mohawk, population 1,806; consumption, 100,000; rate, 30 cents; private ownership.

Pine Plains, population 402; has few meters, but can compel their use; rates, 13 to 80 cents; private ownership.

Richfield Springs, population 1,623; consumption, 3,000,000 gallons; rate, 40 cents; municipal ownership.

Rouse's Point, population 1,856; consumption, 100,000 gallons; has few meters; rates, 6 to 30 cents; municipal ownership.

Skaneateles, population 1,559; pump capacity, 1,000,000 gallons; rates, 20 to 50 cents.

Springville, population 1,883; pump capacity, 1,000,000; rate, 25 cents; private ownership.

Wellsburg, population 874; pump capacity, 360,000 gallons; has no meters, but can compel their use; rate, 20 cents; municipal ownership.

Similar statistics can be given for towns in other states, but these may be sufficient for the present purposes. Where one rate only is given above it is the maximum rate, and in most cases special rates are charged for large quantities of water. Where two rates are given they are the maximum and minimum rates.

Cost of Asphalt Repairs.

Will you kindly let me know where I can gather reliable information as to the maintenance cost of asphalt pavements in all the larger cities of this country?

I would like to have this maintenance cost cover not alone the time after the guaranty periods have expired, but before if possible. That is, the first five years of the pavement and the second five years. In addition, such information as to when pavements were resurfaced and average length of life of asphalt pavements.

K., Minneapolis, Minn.

There is much on this subject in the back numbers of MUNICIPAL ENGINEERING. Reference may be made to the following articles:

In vol. x: "Cost of Resurfacing Asphalt Streets in Buffalo." p. 283.

In vol. xi: "Repair of Asphalt Pavements," p. 294, giving average cost of asphalt repairs for each year up to 11 years after expiration of guaranties, ranging from 1.1 cents per square yard of pavement per year in the ninth year to 10.8 cents in the fourth year, and averaging 5.5 cents for the eleven years. "Specifications for Repair of Asphalt Pavements in Buffalo." p. 357.

In vol. xii: "Cost of Asphalt Repairs in Buffalo." p. 99.

In vol. xvii: "Cost of Asphalt Repairs in Cincinnati." p. 14.

In vol. xx: "Repairs of Asphalt Pavements in Buffalo." p. 97. "Repairing Asphalt Pavements in Chattanooga." p. 129.

In vol. xxv: "Asphalt Pavements and Their Maintenance in Rochester, N. Y." p. 339.

In vol. xxvii: "The Municipal Asphalt Plant at Winnipeg, Man." p. 354.

In vol. xxviii: "Cost of Detroit's Asphalt Repairs." p. 57.

In this number will be found an article on the cost of asphalt and other pavement repairs in Erie, Pa.

If further detail is desired, it can be found in the annual reports of the public works departments of the cities named above. Washington, D. C., keeps close account of cost of asphalt repairs, also Brooklyn, N. Y., and probably any desired minuteness of detail can be derived from their reports as well as those above named.

The last Rochester report, for 1906, has a large insert table giving in very full detail the cost of asphalt repairs, so arranged and combined as to be very satisfactory, as may be gathered from the extracts and derivations from the tables which follow:

COST OF ASPHALT PAVEMENT REPAIRS IN ROCHESTER, N. Y.

Length of guaranty.	Years maintained by city.	No. of sts.	Range of costs for individual streets.	Average cost cts., per sq. yd., per yr.
5	16	1	3.07	3.07
5	15	3	0.85 to 5.10	2.37
5	14	3	0.58 to 3.31	2.42
5	13	2	3.25 to 5.60	4.38
5	12	2	1.45 to 2.16	1.80
5	11	9	0.33 to 15.31	4.82
5	10	9	1.38 to 4.02	2.77
5	9	10	0.09 to 8.03	3.91
10	9	1	1.92	1.92
5	8	6	0.47 to 2.65	1.07
5	7	2	0.22 to 1.59	1.09
10	7	5	0.63 to 10.16	7.04
5	6	5	0.05 to 6.02	1.70
10	6	5	0.21 to 9.38	1.53
5	5	7	0.30 to 6.42	1.88
10	5	1	0.21	0.21
5	4	2	0.89 to 9.02	1.78
10	4	2	0.10 to 0.10	0.10
10	3	3	0.24 to 2.20	0.40
10	2	1	2.38	2.38

The first guaranty on an asphalt pavement in Rochester expired in the summer of 1890. Since that time the average cost per square yard for repairs, based on all the sheet asphalt pavements in use, has been as follows:

Year.	Cost of repairs cts. per sq. yd.
1891	..
1892	..
1893	..
1894	..
1895	0.12
1896	0.43
1897	4.21
1898	1.87
1899	1.67
1900	2.11
1901	3.17
1902	4.72
1903	3.53
1904	5.02
1905	4.69
1906	5.66

With the exception of 1897, when the first general repairs were made, and 1899, 1903 and 1905, there has been a steady increase in the cost of repairs per square yard per year.

Cement Testing—Joining New and Old Concrete.

1. In mixing up test briquettes of neat cement, and not being supplied with all the equipment of an up-to-date testing laboratory, what would be the proper method of determining just when the mortar has reached the proper consistency?

2. What effect does too much water have in mixing—a tendency to weaken, or simply to retard the setting?

3. Something of the ground covered in your book, "Hand Book for Cement Users." Would it be a valuable one for a person such as an inspector or one having supervision over concrete work?

4. Where can I get some data in regard to cement and concrete adhering to cement and concrete which has already set? H., Trenton, N. J.

1. The best method is to add to the cement about 20 per cent. of its weight of water and thoroughly mix the cement and water together. In vol. xxviii, p. 458, of MUNICIPAL ENGINEERING, will be found an article on "Practical Cement Tests Not Requiring a Laboratory," which gives methods of manipulation. In vol. xxxiii, p. 415, is an article on "Simple Tests of Portland Cement," which gives still more detail. From this latter article it will be learned that if the proportion of water named makes the mortar too wet, a ball of the paste 2 inches in diameter, if dropped 2 feet onto the table, will flatten more than half its depth, and if it is too dry the ball will crack badly.

2. Too much water reduces the strength of the mortar on short-time tests, but if the water is not too excessive in amount the strength will be more than regained on longer time tests.

3. The "Handbook for Cement Users" ($3) is a most valuable book for inspectors and supervisors of concrete construction. It gives the best standard methods of testing cement with and without laboratories, the best specifications for cement for all classes of uses, and descriptions and specifications for all kinds of work in which cement is used, as well as much information on cost of work, apparatus, methods of making cement, statistics, etc. Only good and accepted standards are admitted to its pages, and its statements can therefore be accepted as authoritative.

4. The "Handbook" gives some information regarding methods of joining new concrete to old concrete surfaces. In MUNICIPAL ENGINEERING, vol. xxiii, p. 345, will be found an article on "How to Put New Finishing Coat on Old Concrete."

Fireproof Qualities of Cement Block Construction.

A warehouse approximately 200 feet square and two stories high is to be erected by a certain party in this city. The insurance companies, however, refuse to consider a building made of blocks as better than a frame building risk. Will you kindly advise whether you can furnish us with any data, cuts or other information regarding the fireproof qualities of blocks as demonstrated in actual experience? Can you also advise us where we may obtain further information that will assist us in placing the value of concrete blocks as a factory building material fairly before the insurance commissioners?

R. J. SCHWAB & SONS CO.,
Milwaukee, Wis.

Most of the available information on this subject will be found in back numbers of MUNICIPAL ENGINEERING. The question of the sufficiency of concrete blocks as a fire resisting building material is so closely connected with the quality of the blocks and their design that the insurance companies are compelled to consider the character of the building regulations in fixing the rates on concrete block buildings. If there is no restriction on the quality and design of blocks, the companies are practically obliged to make rates for the worst conditions to be found in the city, whereas if the building regulations of the city are as strict as they should be and are strictly enforced, the companies can reduce their rates in proportion to the improvement in conditions. In some cities, therefore, the insurance companies class concrete block buildings with frame buildings and in some with brick buildings, while others put them somewhat below brick buildings and still others somewhat above.

If Milwaukee has not been able to pass sufficiently strong ordinances governing concrete block construction, the first step should be to get such an ordinance. Then the evidence regarding the fire-resisting properties of good blocks of proper design can be presented to the insurance companies with proper backing, and therefore with probability of success in improving the classification of such buildings.

The following articles in MUNICIPAL ENGINEERING will aid, first by showing the qualities of cement construction and especially of concrete blocks for buildings, second by giving examples of building regulations, out of which a reasonably good building ordinance governing concrete construction can be made. It will be noted that there is not much uniformity in the provisions of these ordinances. This arises because the subject is new and there are as yet no fixed standards, so that each ordinance expresses the ideas of a single man or group of men, not much copying of one city by another having been done as yet, especially as regards details.

The following articles are on concrete blocks, fire resistance, and insurance rates:

"Resistance of Concrete Blocks to Fire," vol. xxvii, p. 436.

"Fire Test of Concrete Blocks," vol. xxvii, p. 447.

"Concrete Blocks Fireproof," vol. xxviii, pp. 47, 332, 490, the latter showing a photograph of a single concrete block standing, with all its surroundings completely destroyed by fire.

"Insurance Rates on Concrete Construction," vol. xxviii, pp. 373, 444.

"Concrete Block Insurance and Resistance to Fire," vol. xxix, p. 120.

"Concrete Blocks and Fire Insurnace," vol. xxix, p. 130, by E. T. Cairns.

"Are Concrete Chimney Blocks Fireproof"? vol. xxx, p. 282.

"Fireproofing and Insurance," vol. xxx, p. 339, by E. T. Cairns.

"Concrete Blocks Are Fireproof," vol. xxx, p. 391, with picture of building after fire.

"Fire Protection," vol. xxxi, p. 19.

"Insurance Rates on Concrete Block Buildings," vol. xxxi, p. 448; xxxii, p. 316.

"Fireproofing and Insurance," vol. xxxii, p. 108, by E. T. Cairns.

The following articles are on the fire-resisting qualities of concrete construction in general:

"Concrete in the Baltimore Fire," vol. xxvi, pp. 192, 405.

"Concrete as a Fireproofing Material," vol. xxvii, p. 125.

"Is Concrete Fireproof?" vol. xxvii, p. 186.

"Concrete and Concrete-Steel in the United States," vol. xxvii, p. 441, has a section showing the successful resistance to fire of concrete by several instances.

"Fire Tests of Concrete," vol. xxviii, p. 47, showing photographs of tests and the results on reinforced concrete and on concrete blocks.

"Investigation of the Effect of Heat Upon the Crushing Strength and Elastic Properties of Concrete," vol. xxix, p. 188.

"Fire Test of Reinforced Concrete," vol. xxx, p. 1.

"Conclusions from the San Francisco Conflagration," vol. xxx, p. 283.

The following articles are on the strength of concrete and concrete blocks, and ordinances governing concrete construction:

"Crushing Strength of Hollow Concrete Blocks, Common Brick, Vitrified Brick and Stone," vol. xxvii, p. 371.

"Building Ordinances Regarding Concrete Blocks," vol. xxix, p. 344.

"Building Regulations of Concrete Blocks," vol. xxix, p. 356, giving those of Philadelphia, Pa., and Newark, N. J.

"Concrete Construction According to

Minneapolis Building Ordinance," vol. xxix, p. 441.

"Strength of Hollow Concrete Blocks," vol. xxx, pp. 16, 282.

"Specifications for Hollow Blocks of the Northwestern Cement Products Association," vol. xxx, p. 144.

"Concrete Building Blocks," vol. xxx, p. 253.

"Provisions Regarding Cement Construction in Grand Rapids," vol. xxxi, p. 472.

"Ordinance to Regulate Concrete Building Construction in San Francisco," vol. xxxii, p. 25.

"Ordinance to Regulate Concrete Construction in Pittsfield, Mass.," vol. xxxii, p. 31.

"Building Regulations for Concrete," vol. xxxii, p. 162.

"Building Regulations for Concrete Blocks," vol. xxxii, p. 165.

"Cleveland's Building Code," vol. xxxiv, p. 104.

"Proposed Building Ordinance Governing Reinforced Concrete," vol. xxxiv, p. 57.

Insurance Engineering is a periodical devoted to the interests of fire insurance, and its files contain much evidence of the value of concrete construction for resisting fire, both in descriptive articles and in photographs. It can be used to advantage in discussions of this subject with local insurance rate makers.

Concrete Curb and Gutter on Steep Streets.

Have you an article in one of the back numbers of the magazine relative to the construction, use, practicability, cross-section, etc., of combined curb and gutter upon hillside streets with a grade from 2 to 10 per cent., and especially where paving may not be done? If an article of this nature has never been published, can you get me one, including a few drawings? Would this subject be treated in your book, "Engineering Work in Towns and Small Cities"?

E. S. B., Red Oak, Ia.

In MUNICIPAL ENGINEERING, vol. xvii, p. 190, will be found an article on "Street Grades and Cross Sections in Asphalt and Cement," which gives two forms of cross-section for concrete curbs and gutters, which may be adapted to any circumstances found in the grading of a street on a steep slope. In vol. xxviii, p. 386, is an article on "Concrete Pavements and Paving Materials," the illustrations for which show concrete curb and gutter.

The concrete curb and gutter is particularly adaptable to unpaved streets on steep grades, because, if the gutters and street cross-sections are properly designed, a method of carrying off the storm water is provided which will reduce the wash of the street to a minimum. The crown of the street should be high enough to turn the water falling on the street to the gutter as quickly as possible. The width and the dish of the gutter may be changed to suit the amount of water to be carried if the inlets to drains are not close enough together to let the water out of the gutter before it collects in sufficient quantities to spread out onto the street surface.

Repairs to the street surface must be made frequently enough to keep out all ruts, to take out any channels which may form in the surface and to keep the area next the gutter fully up to the level of the concrete. On long hills without underground drains or sewers it may be found desirable to extend the width of the concrete gutter either with concrete block, brick or stone paving, toward the bottom of the hill, where large quantities of water are likely to flow during heavy rains.

The best specifications for concrete curb and gutter, and the cross-sections of the designs above referred to, will be found in the "Handbook for Cement Users" ($3). "Engineering Work in Towns and Small Cities" ($3) also contains a good design for concrete curb and gutter. It also contains the Chicago specification for concrete curb and gutter and many practical points about gutter design and construction.

Flaming and Metallic Arc Lamps.

I would be pleased to have the meaning and the characteristics of the flaming arc and metallic arc lamps referred to by E. A. Fisher at the meeting of the American Society of Municipal Improvements. Our municipal light plant is antiquated and outgrown, and is now under discussion for general renewal.

C. E. V., ———, O.

The flaming arc lamp is one with characteristics described by Mr. Fisher, using carbons of a peculiar construction and having a long arc, giving an intense light of peculiar color, but not wholly satisfactory except for purposes for which its brilliancy and color are not objectionable. It is made in differing forms by all the principal makers of electric apparatus.

The metallic are referred to by Mr. Fisher in the article in vol. xxxiii, p. 388, and the magnetite lamp, described as to results by Mr. Blackburn on page 348 of the same volume, are practically the same. They are made on similar principles, under different names, by the principal electric apparatus manufacturers. Mr. Blackburn's experience seems to be similar to that of others also. While the first cost of installation of these lamps is higher than that of some others, the excellent results in operation warrant serious consideration of the system for renewal of an old and out-of-date system.

How to Clean Catchbasins.

Can you tell me who makes or sells a machine for cleaning out sewer "wells" or catch basins?

W. W. C., Bridgeport, Conn.

No such machine is known to the writer. Do any of our readers have any specially satisfactory methods of cleaning catchbasins which they are willing to describe for the benefit of others?

Engineering Work in Towns and Small Cities.

I notice a book in your clubbing list entitled "Engineering Work in Towns and Small Cities" ($3) and would like information as to the scope of the work.

B. E. M., Newman, N. Y.

A review of this book will be found in MUNICIPAL ENGINEERING, vol. xxxii, p. 49.

In brief the conclusion of the review is that the book is one for practical instruction in the details of design and construction of municipal improvements of the grades and kinds used in the smaller municipalities. It is the result of the author's experience, which has covered this class of work quite fully.

How to Remove Lines from Tracing Cloth.

Is there any known liquid that will remove black, red, or blue lines from tracing cloth without defacing the surface of the tracing cloth, or in any way injuring the texture of the same?

G., ————————, Pa.

There is a preparation on the market called "Inkoff" which comes nearest the needs described of anything known to the writer, but it must be used with knowledge and care and is not always entirely successful then.

Storage Time of Sewage in Septic Tank.

Please give me some information concerning the proper length of time for keeping sewage in a septic tank to give good results. SUBSCRIBER.

This is a matter concerning which there is not as yet enough known to bring engineers to agreement. Too short time prevents full action and too long time gives rise to conditions which prevent the best results, but the proper time within these indefinite limits depends upon conditions which are so variable in practice that experiment and observation have not yet covered them all.

English city sewage is very perceptibly stronger than the sewage in American cities, where the use of water is much greater in proportion than in England. It may be given as a general statement that English practice accepts length of storage varying from 12 to 24 hours and American practice lies between 8 and 16 hours, but there are numerous exceptions to these rather broad statements. Following are some of the results reported in various articles to be found in the numbers of MUNICIPAL ENGINEERING referred to, the Roman numerals giving the volumes and the Arabic the pages where the plants named are described:

England, 12 to 24 hrs., xix, 262.

Leeds, Eng., 24 hrs., xix, 294.

Manchester, Eng., chemist says local conditions determine time, xxi, 242.

London experiments, 5 hrs. gave 50 per cent purification, xxv, 439.

English practice, 24 to 36 hrs., xxvi, 111.

English practice, 2 2-3 hrs., little improvement; 4 hrs. in wet weather and 12 hrs. in dry gave good results; 8 hrs. good results, 4 to 5 hrs., not so good; 8 hrs. best results; extremes for good results 5 to 14 hrs; 12 hrs. dry weather flow good results, but 24 hrs. too long with double strength sewage; xxx, 36.

Zerbst, Germany, slaughter house refuse, several days; xxxi, 86.

General English requirement formerly 36 hrs., now 24 hrs., many engineers now say 12 to 15 hrs.; can remain too long and become offensive; xxxiii, 312.

Champaign, Ill., 5 hrs., xiv, 93.

Champaign, Ill., 1 hr., too short, xvii, 212.

Brentwood, N. H., 3 to 4 hrs. too short. McClintock says should be 12 hrs.; xviii, 30.

McClintock gives 12 to 24 hrs., xix, 52.

Madison, Wis., 16 hrs. average, xxi, 302.

S. C. Smith, 24 hrs. or a little more, xxi, 85.

Liberty, N. Y., 12 hrs., xxi, 1.

Glencoe, Ill., 23 hrs., xxii, 1.

Vancouver, B. C., 18 hrs., xxii, 208.

New Jersey Sewer Commission, 6 to 18 hrs., xxii, 261.

Snow says 24 hrs., xxiii, 153.

Clayton, Mo., 23 hrs., xxiii, 192.

Downers Grove, Ill., 64,000 gallons cafor 8 to 12 persons, xxiii, 255.

For small tanks, McClintock gives 24 hrs., xxiii, 357.

West Allis, Wis., designed for 20 hrs., actual time 5 hrs., xxvi, 111.

American practice, says W. S. Shields, is 12 to 24 hrs., xxvi, 111.

Santa Monica Soldiers' Home, Cal., 14 to 17 hrs., xxvi, 1.

Richmond, Ind., Insane Hospital, 10 to 14 hrs., xxvi, 178.

T. C. Hatton says 2 to 4 hrs., xxvii, 331.

Plainfield, N. J., 13 hrs., xxvii, 37.

E. Cleveland, O., 10 hrs.; Kenton, O., 24

hrs.; Sandusky, O., Soldiers' Home, 12 to 24 hrs., but 24 hrs. too long; Warren, O., Infirmary, a little over 24 hrs., too long; xxvii, 34, and xxviii, 279.

G. W. Fuller and G. W. Rafter, 12 to 24 hrs., xxix, 36.

Columbus experiments made on 8 and 16 hrs. and 8 hrs. adopted, xxix, 35.

Ballston, Spa., 10 hrs.

Small tank for 1,500 population, 5,300 gallons' capacity, Rafter, xxx, 350.

Kew Beach, Ont., about 8 hrs., xxxiii, 315.

Six to 24 hrs., xxxiii, 339.

Baltimore recommendation, 25,000,000 gallons' capacity of tanks for that city, xxxi, 47.

Downers Grove, Ill., 64,000 gallons' capacity for 3,000 population, xxxi, 48.

Baker's "British Sewage Works" ($2) gives Manchester 12 to 18 hrs.; experiments at Leeds gave 24 hrs. as best; Sutton, 5 hrs.; Exeter, 14 hrs.; Yeovil, over 24 hrs., too long; Barrhead, 24 hrs.; Oldham, 1 hr.; Burnley, 24 hrs.; Birmingham, 4.36 hrs.; Accrington, 12 hrs.; Salisbury, 8 hrs.

Barwise's "The Purification of Sewage" ($3.50) gives Cameron's first tank 30 hrs.; usual English practice, 24 hrs.; Local Government Board requirement, 30 hrs.; 12 hrs. shows 40 per cent suspended matter in effluent and 24 hrs. shows 20 per cent; 24 hrs. if septic tank is used alone, 12 hrs. if followed by an aerobic filter and 8 hrs. if 3 filters are used in succession afterwards.

Municipal Slaughter Houses.

Can you put me in touch with any literature on the subject of municipal slaughter houses, either in the way of periodicals, health reports, or other publications?

Do you know of any cities of fifty thousand or less population who make use of this plan? If you have no data at hand, could you give me the address of some clipping bureau or technical index from which I could likely get the information?

J. R. L., Greenville, S. C.

Most of the literature on this subject is from foreign sources. English magazines having articles on the subject are the *Sanitary Record*, the *Sanitarian, Public Health, Municipal Journal, London, Journal of the Sanitary Institute, New Review.*

Articles in American periodicals are not numerous. Those found in the indexes of periodicals include one on "Abattoirs" in *Municipal Affairs*, vol. 2, p. 720; "The Modern Municipal Slaughtering Establishment at Berlin" in *Scientific American*, vol. 95, p. 68; "Municipal Slaughterhouses of Paris," *Review of Reviews*, vol. 34, p. 86; "Abattoirs," *National Magazine*, vol. 21, p. 285.

Chapin's "Municipal Sanitation in the United States ($5) tries to give references to and extracts from all the laws and ordinances governing slaughter houses in the United States, and uses only four of five pages and records no municipal abattoirs, although several cities exercise direct control over a single private abattoir at which all slaughtering must be done.

FROM WORKERS IN THE FIELD

Practical Points from Practical People.

Contributions to this Department are invited. Give from your experience for the benefit of others. No matter about the style of the composition, the fact is what is wanted. Use the Question Department for what you want to know; use this Department for what you can tell others.

Concrete Pavements.

Editor of MUNICIPAL ENGINEERING:

Sir—We beg leave to call your attention to an article in the March number of your magazine, wherein you answer an inquiry regarding concrete pavements, on page 168, and to add that we have a number of concrete pavements which have been laid as long as nine years and have laid a great many of our pavements during the last two or three years.

We laid some 50,000 sq. yds. for the city of Washington the same year. Letters patent covering our pavement were granted by the Government June 4th of last year.

RUDOLPH S. BLOME CO.,
Chicago, Ill.

Amounts of Materials Required for Concrete.

Morris M. Defrees, M. Am. Soc. C. E., of Indianapolis, uses the following formula for determining the quantities of cement, sand and gravel required for various mixtures for concrete:

$\frac{9.5}{c+s+g} = C$, amount of cement in barrels in a cubic yard of concrete, in which c is the proportion of cement used, s the proportion of sand, and g the proportion of gravel.

The amount of sand required is $\frac{4Cs}{27}$ and the amount of gravel required is $\frac{4Cg}{27}$

For example, the amount of materials required for a cubic yard of concrete made of 1 cement, 3 sand and 6 gravel is determined as follows: 1 (c) plus 3 (s) plus 6 (g) equals 10.

There will be required, therefore, 9.5, divided by 10, or 0.95 barrels of cement. Of sand, 4-27 times 3 (s) times 0.95, or 0.42 cubic yards. And there will be required of gravel 4-27 times 6 (g) times 0.95, or 0.84 cubic yards.

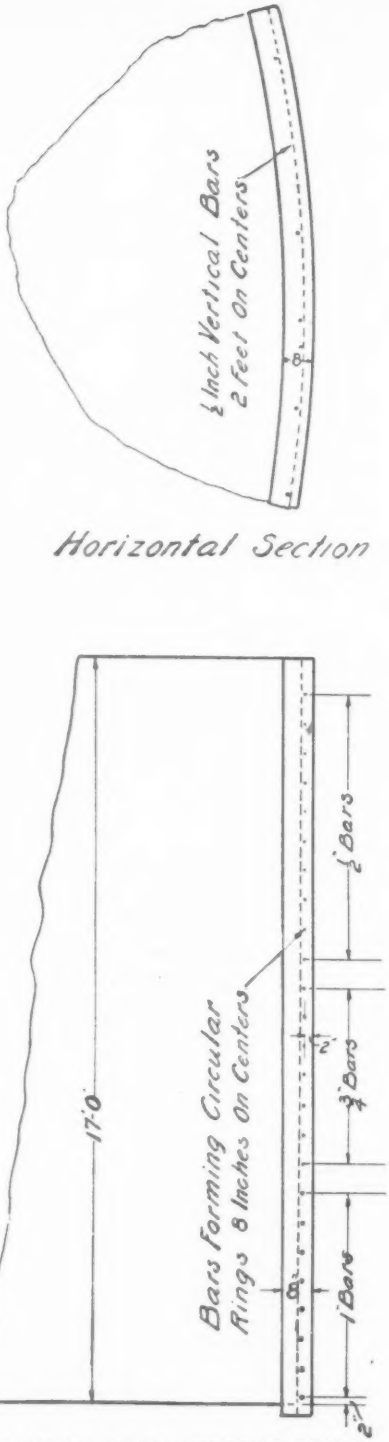
Thacher's table gives 0.92 barrels of cement, 0.42 cubic yards of sand and 0.84 cubic yards of gravel.

Reinforced Concrete Lining for Reservoir.

Editor of MUNICIPAL ENGINEERING:

Sir:—The city of Niles has a water reservoir located on a hill about 1½ miles east of the center of the city. The reservoir is 70 feet in diameter and 17 feet in depth. It is built in rock, which gives a solid rock bottom and rock sides to a varying height of about 6 feet, and from there to the top it is built of stone masonry. It is lined with a 4-inch brick wall from the bottom to the top.

There is a stone quarry about 40 feet deep adjoining this reservoir and about 20 feet from it at the nearest point. The reservoir wall became cracked partly from blasting at the quarry, and partly from the action of the weather. Therefore no water could be kept in the reservoir after raising over 5 or 6 feet, so I was asked to prepare plans for replacing it, and still not take up any more water space than was necessary to make a good wall. I decided to build an 8-inch concrete wall inside the old one, after taking out the 4-inch brick wall, building it from the rock floor up to a height of 17 feet, using Atlas Portland cement, good clean bank sand and lime stone broken to pass a 1½-inch screen and free from dust; the concrete formed by mixing 1 part of cement to 2 parts of sand and that in turn



PLAN FOR LINING CIRCULAR RESERVOIR AT NILES, O.

having about 4 parts of stone added and thoroughly mixed.

The exact proportions are to be regulated by the engineer or his representative at the time of building the wall, but the parts to be approximately 1 part of cement, 2 parts of sand and 4 parts of stone, the proportions being so regulated as to give a slight surplus of mortar when rammed. I reinforced the concrete with rods so as to give it strength enough to hold, even though it did not receive any support from the old wall; and from past results reinforced concrete properly made has stood considerable of a shock, far more than stone masonry, and I believe that this concrete wall will not be affected by any blasting that may be carried on in the quarry hereafter. Rods are used as per the plan hereto attached, making continuous horizontal rings by lapping consecutive bars as follows: the 1-inch bars to have a lap of 36 inches, the ¾-inch bars 30 inches, and the ½-inch bars 22 inches; joints so arranged so that they will not lie in the same vertical plane; half-inch bars to be put in vertical every two feet.

The estimated cost of the work was $2,000.00; the bid on the work was $14.25 per cubic yard for concrete, which included the inside shoring, the old wall being used for the outside shoring. The lump bid for the rods was $600, making the total about $1,900, but there being only one bid it was not accepted.

WM. WILSON, C. E.,
Niles, O.

Roots in Sewer Pipe.

Editor of MUNICIPAL ENGINEERING:

Sir:—The enclosed is not an unusual occurrence in the East, but it is the first instance of the kind here where pipe was laid at such depth. One other case occurred in the city park where pipe was laid at shallow depth.

C. W. SWEARINGEN,
City Engineer, Great Falls, Mont.

Enclosed in Mr. Swearingen's letter was the following concerning roots in a sewer pipe 8 feet below the surface:

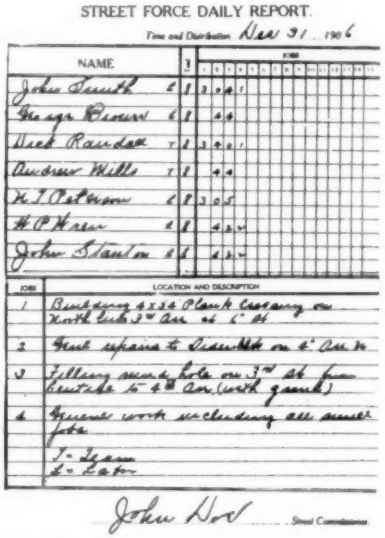
A section of sewer pipe is on exhibition at City Engineer Swearingen's office in the court house, which was taken up near George Longeway's house just east of the Whittier school building. Willow roots from trees situated at least 30 feet from the pipe line had grown out to the street and beneath the pipe and finding an improper connection had worked themselves between the sections and fed by the warm fertility of the sewage had grown down the sewer for a distance of 40 or 50 feet, the roots and tendrils completely stopping the flow.

Engineer Swearingen estimates, from the fact that the sewer was laid in 1893, that the roots have probably been growing in the pipe for about 10 years, the largest of them being about an inch in thickness.

A Daily Report Form for Street Work.

Editor of MUNICIPAL ENGINEERING:

Sir—I enclose a blank form for your inspection. This form is used by street commissioners in towns and small cities. At end of each month a pay-roll is made up and same is accompanied by a distribution sheet showing location, character, and


STREET FORCE DAILY REPORT.

Time and Distribution Dec 31, 1906

NAME	$	JOBS
John Smith	2	1
George Brown	2	1
Nick Randall	2	1
Andrew Wills	2	1
H. J. Patterson	2	1
H. P. Hall	2	1
John Stanton	2	1

JOBS	LOCATION AND DESCRIPTION
1	Building 4x12 Plank Crossing on North Side 3rd Ave at C St
2	Grading Approach to Crossing on C Ave N
3	Filling sunken Lots on 3rd St from Centrale to 4th Ave (with gravel)
4	Grading work including all small jobs
	J. Hall
	L. Lake

John Hall Street Commissioner

cost of work for the month. It enables the city council to keep "tab" on the work and expenditures for same. By reference to these sheets the cost of original work on crossings, maintenance and life of same can be determined when desired at some future date.

C. W. SWEARINGEN,
City Engineer, Great Falls, Mont.

Design for Concrete Arch.

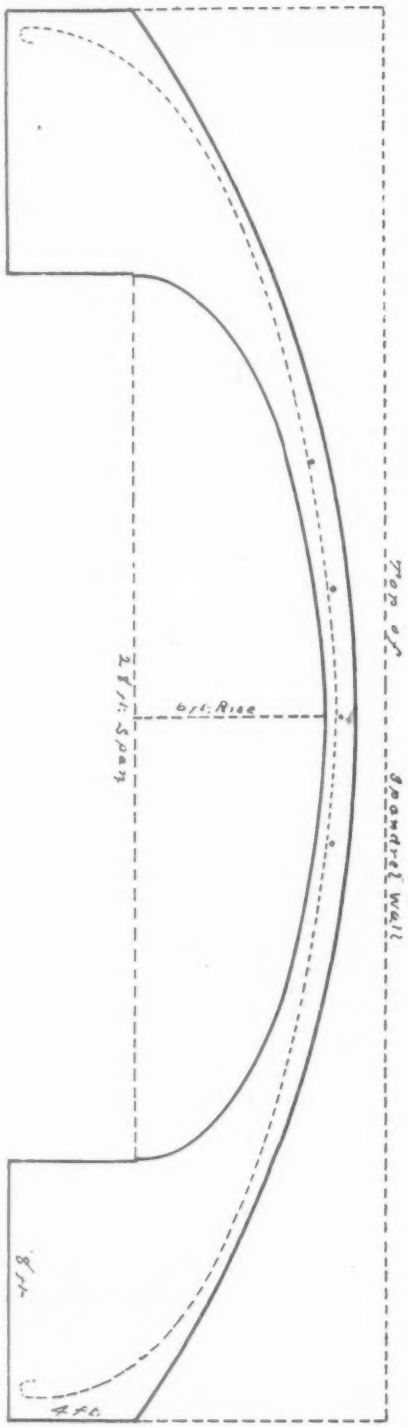
I inclose sketch of plan of concrete arch bridge. I wish you to inform me if the proportions are correct, also as to the location of the reinforcements and as to the size of the abutments. Judging from drawings of similar concrete arches that I have noticed I have more material in the abutments than is necessary, also the arch ring is thicker than it need be. In the formula used for proportioning arch bridges, what is the load assumed for highway bridges? Also in using these

formulas is it necessary to apply both the uniform and concentrated loads as factors? Can you give and explain a formula for designing a concrete arch bridge?

Arch ring reinforced with ¾-inch rods, 12-inch centers and ¾-inch transverse rods, 4-foot centers. Thickness of crown of arch 1 foot.

M., ————, Mich.

Will our readers give their answers to these questions? They will be printed with or without the names of the authors as may be preferred. Give the assumptions of loads made for the locality and the formula or rule used, with such observations as to sufficiency as are available.



DESIGN FOR ARCH.

The Removal of High Turbidity from Water without the Use of Coagulants.

Editor MUNICIPAL ENGINEERING:

Sir:—Slow sand filters as now designed and operated completely fail to give a clear effluent when the turbidity in the raw water averages above about fifty on the turbidity scale and it has been considered necessary to use coagulants and in general the mechanical type of filters when the turbidity of the raw water averages a higher amount.

The construction of the slow sand filter type has heretofore been confined to the region of comparatively clear waters of the Eastern States and the mountainous country of the West, leaving the mechanical filter type in complete control of the South and Middle West.

The cost of coagulant for very turbid waters is a very large item and including with this cost the objections which many communities raise against the use of coagulants, it is very desirable that the slow sand filter be improved so as to remove any degree of turbidity as well as of bacteria.

It has been observed ever since slow sand filters have been scientifically operated that they were able to take care of considerable overloads of muddy water, provided the periods of overload were comparatively short and not too near together.

These abnormal quantities of turbidity are stored in the interstices of the sand grains and gradually work downward through the sand layer and will ultimately appear in the effluent if the conditions are prolonged.

Suppose now that while this storage is in progress and before any turbidity has worked through to the effluent, filtration is stopped and the sand thoroughly cleaned to the depth the turbidity has penetrated, it can be readily seen that this property of storage can be made use of indefinitely and with a proper adjust-

ment of the effective size of the sand and its depth turbidity of any amount is easily removed by slow sand filtration. Such an apparatus for cleaning sand quickly to any depth has been in use at Yuma, Arizona, for four years and has been recently thoroughly tested by the writer, in a six months' test for the city of New York.

The Colorado River water at Yuma is at all times very turbid, at times containing 1 part of silt to 50 parts of water and averaging throughout the year 1 part in 200; that is, a bright pin will disappear from view at one-half to three-quarters of an inch below the surface of the water.

A mechanical filter company first installed a plant here and had to abandon it, being unable to clarify the water with a coagulant, after which a filtration company invented and installed the machine described below, which has successfully clarified the water for about four years, the filter working at the rate of three million gallons per acre per day.

The Blaisdell washing machine consists of an inverted open box about four feet square and two feet deep and suitable operating mechanism. The box is sunk under the water of the filter to the sand surface and is held in position and operated from a platform above, which platform is movable on rails supported by the piers of the filter. The box contains a revolving hollow axle and a hollow head from which hollow teeth project into the sand any desired distance.

By means of suitable electrically driven mechanism, all under the control of one operator, the box can be raised or lowered and the platform can be moved forward or backward or sideways. By moving the platform the box is caused to slide over the surface of the sand at a speed of about 10 feet per minute, while at the same time the hollow head and teeth are made to revolve slowly, stirring the sand mechanically. Water under a pressure of 10 to 20 pounds per square inch is introduced through the hollow axle, head, and teeth, and passes in strong fine streams into the sand through fine holes in the teeth.

A suction pump connected with the top of the box is made to draw away just a little more water than is supplied through the teeth and thus carries away and discharges to a sewer all the dirt which has been stirred and washed from the sand.

On account of some water being drawn inward from the filter into the box under its edges through the sand to make up the deficiency between the amount pumped out and that let in through the teeth, none of the dirty water escapes from the box into the filter, but it is all carried away and discharged through a flexible hose into the sewer.

The box is slowly moved ahead over the sand and thus every part of the sand surface is gone over and cleaned, after which the machine is lifted from the filter and filtration started.

All of the operations of the machine are at all times easily under the control of one operator by simply throwing electrical switches.

This machine was perfectly successful under the New York experiments and has been recommended for adoption when the proposed Croton filters are constructed.

By its use and the intelligent proportioning of the effective size of sand, depth of sand, rate of filtration of water, depth of the sand washed at each cleaning and rate of travel of the machine during washing, any practical degree of both turbidity and bacteria removal is possible, without the use of any coagulant.

The saving of all cost for coagulant and the very small cost of operation of the cleaning machine, make the maintenance cost of this new method very much less than that of any other and bring the total capitalized cost of an investment for filters much less than for either regular slow sand or mechanical filters, thus bringing filtration within the reach of many communities now holding back on account of cost.

WILLIAM B. FULLER,
Consulting Engineer, New York City.

WATER AND SEWERS

Mohawk River Pollution—Redwood National Park—Sewage Disposal Plant Efficiency—Control of Stream Pollution

Pollution of Mohawk River Is Serious.

Following a recent investigation into the cause of the pollution of the Mohawk river, Eugene H. Porter, commissioner of the State Department of Health, has prepared a report, in which he states that a serious condition is prevalent, and that a menace exists to the health and lives of the communities which are located along that river and depend upon its water for a potable supply. The Department of Health recommends prohibiting the discharge of any additional unpurified sewage or industrial waste into these waters, requiring the installation of methods of sewage purification so as to remove the existing pollution, and demanding a purification of sewage and industrial waste from all cities and villages situated along the river. An effort will be made to induce all communities which use unfiltered water from the Mohawk river or its tributaries for water supply purposes to filter their supplies.

A Redwood National Park Is Wanted.

The forest service, at Washington, D. C., has received a petition, signed by nearly 1,400 school children of California, asking for the establishment of a redwood national park. The petition comes from Eureka, Humboldt county, and states that they feel that representative groves of these trees should be preserved for themselves and coming generations of children. There is little, if any, redwood left, suitable for a national park, that has not fallen into private hands. The acquisition, therefore, would have to be brought about through purchase or through private donation. If it is found necessary to purchase the land for the park, congressional action will be required.

Efficiency of Sewage Disposal Plants in New York.

The completion of the first thorough and careful investigation of the working of every sewage disposal plant in the state of New York has been announced by the State Department of Health. More than fifty plants were examined, and the report issued by the department on this work contains a complete description of the plants, their operation and management, with plans and photographs, and analyses of the raw sewage and effluents from the plants. This work is regarded as important in connection with the purification of streams and the efforts to preserve water supplies from pollution. A policy has been outlined by Dr. Eugene H. Porter, State Health Commissioner, preventing pollution of streams and protecting water supplies by refusing to grant permits for the discharge of raw sewage into waters of the state, thus compelling the building of disposal plants. Such progress is being made that the commissioner believes a few years will see the building and operation of a great number of these plants, thus avoiding nuisances and unhealthful conditions and protecting the health of the cities using streams as public water supplies. The report sets forth fully the sizes and classes of sewage disposal plants, with comment on the results obtained. Municipal plants are divided into two classes—complete plants and partial treatment plants. The complete treatment of municipal sewage is comparatively new, the report showing that among the sixteen places noted, the oldest—that at Brewster—was constructed in 1893. That plant does not represent modern ideas of treatment, however, the oldest plant involving modern notions having been built at Liberty in 1900. Plants for partial treatment are much older, those involving chemical treatment dating back to about 1890. The oldest types of plants for partial treatment are those found in Dolgeville, Saugerties, Bronxville and Skaneateles. The best type of complete treatment generally applicable through the state may be seen at Ballston Spa, Brockport, Dansville, Penn Yan and Fort Edward. The plants at Lake Placid and Saratoga are types of plans which will give the greatest efficiency, but are confined, unfortunately, to the localities where sand can be found. The report describes fully the plants at state and smaller institutions.

These plants will be kept under continual observation by the department, and by systematic analyses of the raw sewage and effluents the value of the plants in connection with the variation in construction and the character of the sewage may

be pointed out as a guide to municipalities contemplating the construction of similar plants.

State and National Control of Stream Pollution.

In an address before the Washington Society of Engineers, Washington, D. C., March 17, Calvin W. Hendrick, chief engineer of the Baltimore sewerage commission, discussed the new sewerage system under course of construction in Baltimore. He stated that the United States government must soon take up the problem of sewage disposal in American cities. Regarding the subject he said:

In a country like ours, with such wonderful distances, cities and villages being so remote from one another, little thought has been given to the sewage question other than emptying it into the nearest flowing stream. The marvelous growth of the country has brought us face to face with a new condition, which has been allowed to continue too long. Numerous small towns and cities are springing up on rivers and streams in close proximity to one another, causing complaint from those who are receiving the sewage from the towns located above them. It is unreasonable to expect one city to drain its sewage in such a manner as to injure its neighbor without causing damage suits.

The Passaic river is an instance where the conditions have become very acute in this respect. The various municipalities throughout the Passaic basin empty their sewage in the Passaic river, which, being of comparatively small size, has become a great nuisance to the residents along its banks, both in odor and in depreciation of property. It was once a pleasure resort, but is now a foul, black stream. The question has been taken up by the legislature, and plans are being pushed forward to remedy the situation. There are many other cases which are every day growing more acute, and will have to be dealt with sooner or later.

The time is not far distant when the United States government will have to take hold of the disposition of the sewage of the various cities by framing and imposing certain laws governing the disposal of sewage, both as to methods and conditions. As rivers flow from one state to another, it is really an interstate matter.

After discussion lasting over a period of fifty years, the speaker stated, the people of Baltimore awoke in 1904 to the conditions and decided to install a modern sewerage system. Under the new system all the sewage will be carried to a point five and a half miles from the city limits, there purified and emptied into Back river, twelve miles from Chesapeake bay. For a large area of the city, which is high, a gravity system is to be built; for the remainder, which is low and in the vicinity of the bay, a sewer below tide level will be constructed and the water pumped to the higher level.

Two separate systems will be constructed, one for storm water and one for sanitary sewerage. The sanitary system calls for 850 miles of sewers and house connections, costing approximately $14,000,000. The storm water system requires about 183 miles of drains, costing about $4,500,000. The work will be completed, it is expected, in 1914.

STREETS AND HIGHWAYS

N. Y. State Aid Highways—Curbing Country Roads in New Jersey—Automobiles and Boulevards—Brick Paving—Street Traffic Regulation

Many Applications for State Aid for New York Highways.

According to a statement made March 2 by State Engineer Skene, of Albany, N. Y., there are now 977½ miles of proposed improved highways on the list awaiting construction. The estimated cost of this proposed work is $9,692,755. Preliminary surveys have been made, estimates ascertained and plans approved by the supervisors and returned to the state engineer's office. A bill is now before the legislature asking for an appropriation of $7,000,000, but Mr. Skene says he does not believe this will be sufficient to provide for all the new highways asked for.

New Jersey Bill to Authorize Curbing of County Roads.

A bill was introduced in the House at Trenton, N. J., March 4, which permits municipalities to lay curbs, gutters and sidewalks on county avenues under the same regulations as other roads are curbed. There is at present no authority given by the road board acts for these improvements. The bill is framed to permit the Essex County Park Commission to develop Park avenue, which is under its control, as a parkway, and the bill will permit the municipalities to lay curbs and gutters in the street. The commission now has authority to pave it.

Bad Effects of Automobiles on Chicago Boulevards.

The destruction of Chicago's boulevards by the "grinding" of automobile wheels is declared, by J. F. Foster, general superintendent of the South Park system, to be a danger that menaces the system. He says the danger from this source has been so great that unless some new method is discovered for protecting macadam pavements, the crushed stone road is a thing of the past.

Mr. Foster has under his direct charge 45 miles of boulevard and park roads, and the greatest difficulty he encounters in his supervision of the roadways under control of the South Park commissioners is in preserving level surfaces. He says:

We constantly are repairing, rebuilding, and experimenting, and we can't see our way out of the troubles. We hope to keep a few stretches of macadam as they are for a year or two, but it seems that paving methods must be revised to meet the advance in civilization marked by the frequence of the motor car.

Tests of durability of different materials have not been confined to rough products—limestone and granite—that a few years ago sufficed to meet the requirements of roadmakers. Every new device in the way of tar coating, oil sprinkling and concrete mixing has been given a trial.

The greatest problem confronting park commissioners throughout the country is the preparation of some plan for inexpensive, comparatively durable, and attractive pavements. We are in receipt of letters from all over the country asking for our solution of the difficulty, and we are obliged to admit that it is not yet discovered.

Until recent years the macadam road was the most successful. Asphalt is hard, stiff in appearance, noisy, and, in wet weather, is slippery. Crushed stone, limestone being the cheapest, and granite dressed with limestone being the most satisfactory, provided a beautiful, white street that practically was a dirt road so far as comfort and quiet were concerned. It cost only a small portion of the expense of asphalt and so was adopted generally throughout the country.

Then came the automobile. There are people who say they can see no difference between the effect of a carriage wheel and that of an automobile. One is beneficial and the other destructive. The former simply acts as a roller, while the motor-driven tire drags at the pavement, digs in and tears loose the stone. Suction has little part in the damage. It all comes from the wheel where the "purchase" to push ahead must be secured.

It is impossible to estimate the damage to roads done by chains used on tires. It is certain that they dig into the stone more than a smooth tire, but the wear on the pavements in summer is almost as bad as in winter, when chains are used. The greater damage in the latter season might be attributed to the fact that the stone is wet and more easily loosened.

Some people imagine that places where ruts are worn in the regular path of the machines present the worst phase of the damage. They do not. A little dressing and a few trips of the steam roller often remedy such defects, and the worst damage we find is where cars just "skin" the surface of the road. Then we have to resurface, and that costs from 20 to 40 cents a square yard.

Brick Paving Is Popular.

At the annual meeting of the National Paving Brick Manufacturers' Association, it was decided to locate the corresponding secretary's office in the city of Indianapolis, and that office is now at 522-523 Board of Trade Building in that city. At these headquarters, the first meeting of the National Board members was held on March 12th. Reports submitted to the meeting show that manufacturers belonging to the Association furnished 4,250,396 yards of pavement for 1907, and while there are but very few contracts let in the winter season, a change for the better in this respect is noticeable, as the reports show during January and February 216,341 yards of brick pavement were let.

With one or two exceptions all members were present. In view of the conservative tone maintained generally throughout the country, the reports promise a fair amount of pavement for the ensuing year.

Requests from municipal officers, especially engineers, for copies of specifications for building brick streets, and correspondence from the municipal officers and engineers show that the efforts of the Association in behalf of brick construction are very greatly appreciated, and the Association on its part is gratified and pleased with the co-operation and progress made in this behalf.

Sensible Street Traffic Regulations Necessary.

Hayden Eames, general manager Studebaker Automobile Co., South Bend, Ind., expresses himself on street traffic regulation as follows:

The Anglo-Saxon race prides itself upon being essentially practical, but officials, even at that rate, are prone to assume the definite where only the indefinite exists. The rigid, blind and strictly literal enforcement of our municipal automobile speed law to the disregard and neglect of well established road laws, instead of accomplishing its intention of rendering our streets safe, has in reality contributed materially to increase their danger.

It is a common sight in the rush hours of the morning to see the center of a much traversed street occupied by three or four coal teams and a couple of milk wagons gently beating up the streets from side to side, surrounded by a swarm of automobiles, all operating within the law, playing hide-and-seek around the meandering coal wagons to the imminent risk of all concerned. The confusion of the situation is frequently heightened by some truly reckless automobilist who comes round the corner well within the speed law and precipitates himself into the midst of

the mass going in the opposite direction. I have seen as many as three such cases in one day in which the escape was so narrow as to attract the startled attention of nearly everybody in sight, and in every case the trouble was primarily due to the non-regulation of teaming traffic and a reckless turning of corners by automobilists operating strictly within the law as actually enforced.

I for one have confidence enough in the average judgment and integrity of the members of our police force to leave to the judgment of the observing policemen the question of whether or not any given driver of automobile or horse is or is not properly regarding the safety of the streets, irrespective of any definite speed limit. The few cases of officiousness will represent a very small penalty to pay for the resulting improvement in safety and comfort. The intelligent enforcement of a fundamental driving law coupled with an enforcement against all vehicles of the well established rules of "Keep to the right" and "Slow vehicles to the curb" will work a revolution in the direction of safety.

New Accounting System for Springfield, Ill.

A new accounting system has been installed in the municipal offices of Springon the record book as soon as brought field, Ill., by Marwick, Mitchell & Co., of Chicago. Under the new system the city comptroller will be the pivot around which all the departments will move, and the work will be concentrated in this office. Reports are to be made from each department each day.

In the comptroller's office will be a fixed asset ledger, a revenue ledger, an expenditure ledger, a special assessment ledger, a miscellaneous ledger, a general journal, a voucher register, an index and proper filing system, special voucher form register, warrant for collection register, an anticipated tax warrant register, a bond record, a special bond record, an insurance record, and a record of all licenses issued. The comptroller is to make a report every month on the finances of the city. The other departments of the city will have to keep books and return vouchers to the comptroller. The police departments are required to keep a record of all arrests, such arrests to be placed into the city.

Municipal Improvements in Little Rock, Ark.

E. A. Kingsley, superintendent of public works in Little Rock, Ark., has made his report for 1907. It shows unusual activity and progress, but a reduction of expense of operation of the department of about $1,800 from 1906, although a plan for a new system of sewers was made and paid for during the year.

Less sidewalk work has been done than heretofore but sewers and paving have increased rapidly. Two disposal plants have been built, giving outlets for three sewer districts. Nearly six miles of sewer were built at a total cost of about $32,000. Most of the 55 miles of sanitary sewers now in existence have been built in the past five years. Nearly 12,000 linear feet of brick paving have been built at a cost of about $66,000; 8,600 feet of macadam for $15,000; and over 14,000 feet of asphalt for $135,000. This makes 6.5 miles of paving, three times as much as in any previous year. In addition to the $216,000 expended by the city the street railway company has expended about $250,000 for brick pavements in the same districts. The city now has 0.73 mile of granite block, 6.11 miles of brick, 4.26 miles of asphalt, 0.41 mile of asphaltic macadam, and 5.33 miles of macadam pavement.

Much paving is in prospect for 1908, probably 4 miles or more of asphalt, brick, asphaltic macadam and macadam. No work has yet been done on the new sewer system which will be additional to the sanitary system which now covers most of the thickly settled portions of the city and the 13.7 miles of old storm sewers.

Business Rivalry Between Birmingham's Municipal Light and Power Plants.

In a report regarding the conduct of the electric light and power plant owned by Birmingham, England, Consul Albert Halstead says:

The electrical supply committee of the Birmingham city council has been authorized to expend £20,000 ($97,330) for the purchase of motors. The idea is to increase the use of electricity as a motive power among small manufacturers by permitting them to hire motors from the city for power purposes. This, I believe, is a new departure in municipal business activity. At the same time there has been a reduction of the scale of charges for electricity for power purposes. Birmingham has expended several million dollars in erecting its modern electric power houses. It furnishes electricity not only for lighting and power purposes, but for the electric street cars, which the city also owns and operates. An additional plant has to be provided at an estimated cost of £231,285 ($1,125,548). There is friendly rivalry between the electric supply committee and the gas committee of the Birmingham city council for business, each committee endeavoring to promote the use of its lighting and power facilities. The rivalry is keen, and it would seem as if it should be of advantage to both committees by leading to increase in the use of their supplies.

ORGANIZATIONS AND INDIVIDUALS

Technical Associations—Civil Service Examinations—John Wharton Maxcy—Charles Cottingham—William D. Marks

Technical Associations.

The annual meeting of the New Jersey Association of County Engineers was held at Trenton, February 27. Officers for the ensuing year were re-elected as follows: President, J. J. Albertson, of Magnolia; secretary, Robert A. Meeker, of Plainfield; treasurer, Joshua Doughty, of Somerville. An address by President Albertson, on "The Prevention of Dust and the Result on Our Highways," and a paper by Frank J. Eppelle, county engineer of Mercer county, on "The Calculation of Cross Sections of Roads," were features of the meeting.

The next meeting of the Interstate Cement Tile Association will be held at Webster City, Iowa, June 23.

The 274th meeting of the New York Electrical Society was held in Assembly Room No. 2, Engineering Societies Building, 29 W. 39th st., February 28.

The annual meeting of the American Water-Works Association will be held at Washington, D. C., May 11, 12, 13, 14, 15 and 16. John M. Diven, secy., 14 George st., Charleston, S. C.

The annual convention of the National Electric Light Association will be held at Chicago, Illinois, May 19, 20, 21 and 22. W. W. Freeman, secy., 29 W. 39th st., New York City.

The annual convention of the American Society of Civil Engineers will be held at Denver, Colo., in June. C. W. Hunt, secy., 220 W. 57th st., New York City.

The annual meeting of the American Society for Testing Materials will be held at Atlantic City, N. J., June 23, 24, 25, 26 and 27. Edgar Marburg, secy., University of Pennsylvania, Philadelphia.

The annual convention of the American Institute of Electrical Engineers will be held at Atlantic City, N. J., June 29, 30, July 1 and 2. Ralph W. Pope, secy., 33 W. 39th st., New York City.

The 28th annual meeting of the Civil Engineers' Club of Cleveland was held March 10. Officers were elected as follows: President, Willard B. Beahan; treasurer, John H. Fox; secretary, Joseph C. Beardsley, 1200 Schofield Bldg., Cleveland.

The last monthly meeting of the season of the New England Water-Works Association was held in Boston, March 11. Dr. George A. Soper read a paper entitled "The Typhoid Fever Epidemic at Watertown, N. Y., in 1904," and E. L. Grimes, city engineer of Troy, N. Y., read one on "Troy Water-Works Extension," each paper being illustrated by lantern slides.

The International Society of State and Municipal Building Commissioners and Inspectors issues some firy literature upon the subject of better building for protection from fire, which would have more effect if it were not in quite so exaggerated form of statement or so prejudiced in its approval of certain methods and condemnation of others concerning which the secretary of the society has frequently placed himself on record against the combined experience of many engineers and constructors expert in fire resisting construction.

The American Civic Association has inaugurated a campaign against billboards in the same energetic fashion as its campaign for the preservation of Niagara. This is a movement in which everyone can help by attacking the nuisance in his own neighborhood, and what one does will not only encourage others but make it easier for them to attain success in their particular part of the contest.

The American Society for the Prevention of Cruelty to Animals offers a reward of $500 for the device or apparatus not now in use which will best accomplish the humane destruction of animals used for food purposes, the competition to close June 1, 1908. Full particulars will be given by Alfred Wagstaff, Pres., 50 Madison ave., New York City.

The Illinois Association of Contractors engaged in municipal work met Feb. 27, and formed a temporary organization, and at a later meeting held March 10 a permanent organization was perfected. A. D. Thompson, of Peoria, was one of the leaders in the movement.

Municipal Elections.

Municipal officers have been elected and re-elected as follows:

Atlanta, Ill.—Mayor, William Hunt.

Clerk, M. M. Hoose. Street Commissioner, George Huber.

Washburn, N. D.—Mayor, T. J. Haugeberg. Treasurer, C. G. Forbes. Aldermen, J. A. Brummond, Martin Holtan, Frank Thompson, L. M. Wallin, William Benn.

Augusta, Me.—Mayor, Frederick W. Plaisted.

Brewer, Me.—Charles H. Small.

Belfast, Me.—Edgar F. Hanson.

Bangor, Me.—John F. Woodman.

Biddeford, Me.—Cornelius Horigan.

Charles Cottingham.

Mr. Charles Cottingham has been a very busy man in Danville, Illinois, ever since he located there as city engineer after a thorough course in civil engineering, graduating from Purdue University and obtaining his degree of C. E. by post graduate study at the University of Michigan, and a year's travel studying the most important engineering works of this country and Canada.

Mr. Cottingham's experience has been quite varied. As city engineer of Danville, he had direct charge of all pavement, sewer, sidewalk, bridge and park improvements, and reproduced on a series of maps of the city the grades and data of all previous public work. As topographical engineer he was employed at the Chicago World's Fair, and has designed grade systems for a number of cities and villages. His plans for park improvements, submitted in competition, were accepted and included detailed estimates of cost. In sewerage and sewage disposal he has been construction engineer of the systems at Ann Arbor, Mich., and Havana, Ill., designed and constructed the system at Rossville, Ill., and has made plans and specifications for systems at LeRoy, Hoopeston and Robinson, Ill., supervising the construction of the last, including septic tanks. Mr. Cottingham has been contracting engineer on a large portion of the brick, pipe and concrete sewers constructed in Danville and vicinity in recent years. He has made plans and specifications for water-works plants at Oakland and Donovan, Illinois, and for light and water plant at Cayuga, Indiana. He has made the surveys, plans and specifications and supervised the construction of sewers, brick and asphalt pavements, water pipe extensions, etc., in a score of the cities and villages of eastern Illinois and western Indiana. He is engineer for drainage districts in several counties, the one providing for the drainage of the cities of Champaign and Urbana, Ill., bids for which will be received on the 4th inst., requiring the excavation of one million cubic yards in its construction and involving a critical study of the requirements of the drainage conditions in those university cities. He was engineer to the contractor for the construction of the interurban railroad from Danville to Champaign, and has recently made the survey for the location and construction of an interurban line from Covington to Crawfordsville, Ind., including detailed estimate of cost of construction, designs for bridges, operating expenses, gross and net earnings, maintenance, and industrial report.

The total cost of the improvements contemplated under his plans made during one season alone, on most of which construction has begun or has been completed, is two and one-half million dollars.

One who has had so many works under way has numerous reports to make upon projects for drainage, paving, mining, etc., and requests for expert testimony and Mr. Cottingham has his share of these calls.

CHARLES COTTINGHAM, C. E.,
DANVILLE, ILL.

He has published city and county maps and has written upon the subjects of good roads and farm drainage and has spoken before engineering societies. He has printed a report made recently upon a sewerage system for a city of 6,000 inhabitants, setting forth the conditions and problems usually met in cities of this size at the time they find it necessary to take up the matter of sewerage for a permanent solution. It is a brief treatise on the application of the principles of the separate system of sewerage to the plans for the sanitary drainage of any such city, including sewage purification, construction, maintenance, house drainage and plumbing. It is a valuable booklet for municipal officials considering sewerage.

Civil Service Examinations.

Civil service examinations will be held at the usual places by the U. S. Civil Service Commission, as follows:

April 15: Engineer with knowledge of ice machinery, pumping and electrical plants, at $900 a year, in Indian Service, Colorado River Agency, Arizona.

April 29: Magnetic observer, temporary, in Coast and Geodetic Survey, at $60 to $75 a month, with exceptional cases $100 a month.

May 6: Apprentice in Mint and Assay Service at Philadelphia, New Orleans, Denver and San Francisco, at $3.50 a day first year, $4 second and $4.50 a day third year. Open only to graduates in metallurgy or mechanical engineering, and chemistry of 1908 or previous years.

May 6, 7: Chief engineer, third class, on Coast and Geodetic Survey in Philippines, at $415 a month, with promotion on arrival at Manila to first-class, at $140 a month.

May 6, 7: Junior engineer in technologic branch of Geological Survey, at $1,020 to $1,380 a year.

Personal Notes.

C. B. Wells has been appointed city engineer at Wichita, Kas.

Sam Huston has resigned as state highway commissioner of Ohio.

W. A. Gwynn has been appointed city engineer at Key West, Fla.

Edward K. Coe has been appointed city engineer at Duluth, Minn.

J. H. Weatherford has been re-elected city engineer at Memphis, Tenn.

S. Cameron Corson has been re-elected borough engineer at Norristown, Pa.

G. W. Ferguson has been elected county engineer of Cattaraugus county, N. Y.

Frease & Sperling, of Wilkinsburg, Pa., have been appointed engineers of Verona, Pa.

Perry Hale has been reappointed superintendent of water-works at Middletown, Conn.

Hon. M. B. Maxwell, mayor of Eveleth, Minn., died suddenly February 28, of heart failure.

A. E. Martin has been re-elected superintendent of the water board at Springfield, Mass.

James A. O'Brien has been appointed city engineer and superintendent of streets at Chelsea, Mass.

Shiras Morris has been appointed water commissioner to succeed Henry Souther at Hartford, Conn.

Robert J. Harding has been appointed superintendent and engineer of the board of public works at Poughkeepsie, N. Y.

H. C. Allen has resigned as city engineer of Great Falls, Montana, to accept the position of city engineer of Glasgow, Mont.

Neil C. Fenkel has resigned as mechanical engineer of water-works at Detroit, Mich., to become civil engineer of water-works at Erie, Pa.

Robert H. Simpson has been reappointed assistant city engineer at Columbus, Ohio. He will have charge of the work of eliminating grade crossings.

William E. Foss, of Boston, Mass., has been engaged by the board of works at Newark, N. J., to investigate the electrolysis of water mains in that city.

Joshua Atwood, chief engineer of the street department at Boston, Mass., has been appointed superintendent of the street cleaning and water department.

J. Henry Bacheller has been reappointed on the New Jersey Potable Water Commission, and William S. Acker on the Passaic Valley District Sewerage Commission.

Maynard A. Tenney, who has been connected with the city engineer's office at New Britain, Conn., has gone to Cuba on some special work for the department of public works.

George Howe has been transferred from the filtration works at Columbus, Ohio, to the office of the city engineer in connection with the proposed work of eliminating grade crossings.

M. Tschirgi, Jr., Dubuque, Ia., has changed the firm's name to M. Tschirgi & Sons, and his sons will hereafter be actively engaged with him in the engineering and contracting business.

Prof. A. W. French, professor of civil engineering in Worcester Polytechnic Institute, has been appointed a member of the newly created commission on public improvements at Worcester, Mass.

S. Bent Russell, a consulting civil engineer of St. Louis, has been appointed chief engineer and superintendent of water-works at Louisville, Ky. He formerly was an engineer connected with the St. Louis water-works.

The Freeborn Engineering and Construction Company, of Kansas City, has been awarded the contract for the engineering and construction work on the plant of the Crushed Stone and Filler Co., at Sugar Creek, Mo. The engineering work has started and construction work will follow immediately.

Mr. C. L. de Muralt, Consulting Engineer and Professor of Electrical Engineering at the University of Michigan, is giving a course of lectures to the senior electrical engineering students at Ann Arbor on the "Electrification of Steam Railroads." Prof. Muralt, who has been lecturing during the last semester on the underlying phases of this subject, such as the power station equipment, transmission and working conductors, motor characteristics, etc., intends to supplement these by a discussion of the technical and commercial features of the following subjects: (1) "The General Electrification Problem;" (2) "The Reasons for Electrification;" (3) "The Operating Characteristics of Steam and Electric Locomotives;" (4) "The Choice of Electric Systems;" (5) "An Analysis of the Cost of Operation;" (6) "The Field of Railroad Electrification: the Congested Terminal, the Mountain Grade, and the Trunk Line," and (7) "Preparation of an Electrification Project for a Particular Road," special attention being directed to such problems as the design of locomotives, the calculation of run sheets, the choice of speeds, study of the peak load, the location of substations, the economics of transmission and other collateral topics.

MACHINERY AND TRADE

A Structural Slide Rule.

The structural slide rule, devised by John L. Hall, has been in use by structural engineers for about two years, and wherever used it has entirely replaced the old method of using the hand books for strength of beams, columns and compression members in trusses. All problems relating to uniformly distributed loads are instantly and accurately answered by the Beam slide rule, while the Column slide rule gives the allowable stress in struts of any length and radius of gyration.

The form and construction of the rule is an agreeable and novel departure from ordinary slide rule construction. The triangular form of the rule makes it a convenient architectural scale. Each face is a complete and distinct slide rule, one for columns, one for beams, and the third for general calculations.

The Beam and Column slide rules are so simple in operation that draughtsmen unfamiliar with ordinary slide rule computations readily learn to use them.

The Slide Rule Manual is a handy pocket-size oblong booklet of about fifty pages, giving a clear idea of the uses of the Structural Slide Rule, and containing 34 general problems for the Manheim rule, 3 for the Column rule, and 11 for the Beam rule, each problem being illustrated by specific examples on an opposite page. The Rule and Manual are published by the Slide Rule Club, Box 12, Station J, New York City, the Rule for $6 and the Manual for 50 cents.

Open Market for Coal-Tar Cements.

The National Bitumen Co., of Indianapolis, manufacturer of coal tar products, has recently enlarged its works in the way of adding an additional distilling plant, which will greatly increase its capacity. This company has the reputation for making the highest grade of bituminous cements, in which it does an extensive business, supplying these products to the street paving contractors, especially those engaged in the building of bitumineral and other bituminous pavements. Quite an impetus has been experienced in this company's business, due largely, it is claimed, to the recent court decisions adverse to the owners of various patented bituminous pavements, which lead to the general impression that contractors are free to buy the cements in the open market.

Greatly Increased Use of Concrete in Porto Rico.

The value of concrete as a building material has been fully recognized on the island of Porto Rico and today is playing a most important part in construction of all kinds. Credit is due the Century Cement Machine Co., of Rochester, N. Y., who through their able representative, F. B. Hatch, of San Juan, introduced the first concrete block machine on the island and today have seventeen of their well-known Hercules machines in active operation in various parts of Porto Rico.

Mr. F. B. Hatch alone constructed in 1906 buildings costing over $80,000, and among these, a warehouse for the Porto Rican American Tobacco Co., 368 feet long. The board of education has recommended and endorsed concrete blocks as made on Hercules machines, and as a result, they are being used in the construction of all educational institutions throughout the island.

While concrete blocks have been playing a great part in construction, there is also a wide field for street improvement. The Century Cement Machine Company recently placed in the city of Arecibo one of their outfits for making and laying combined curbing and gutter, and as a result Mr. Arturo Prado has the honor of laying the first concrete curbing and gutter ever seen in Porto Rico. The mayor of Arecibo and the city engineer have both complimented him highly upon the fine appearance of the city streets and it is but a question of a short time before all the leading cities will specify concrete curb and gutter. Concrete is not a coming building material in Porto Rico. It is already there.

A Concrete Block Fire Test.

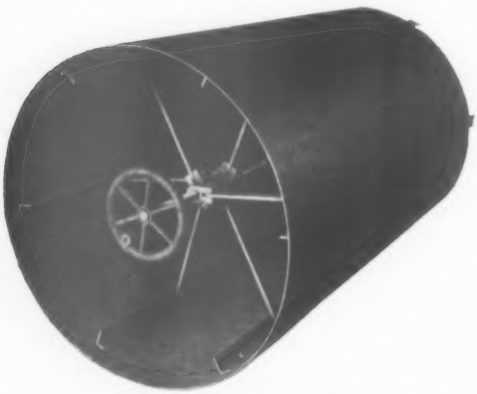
A concrete block fire test was afforded by a fire in a three-story building of the Gospel Trumpet Co., of Anderson, Ind. On Dec. 9 the interior of this structure was completely destroyed by fire. The building was new, having been completed about ten days, and was not yet filled so

that probably the fire was not so hot as it would have been had the structure been occupied. No water connections had been made and it was difficult to get water on the fire in time to check it to any extent. The interior of the building was completely destroyed, the only thing left standing being a steel beam supported by a steel post. The concrete blocks were not injured and there is no necessity of rebuilding any portion of the structure in which they were used. Over a few windows where the flames burst forth, it will be necessary to clean the faces of the blocks, but elsewhere they show no signs of the fire. The blocks were made on a Hercules machine using a very wet mixture, much wetter than it is customary to employ in block making. It is considered that the dense texture of the concrete resulting was largely influential in producing the excellent showing made by the blocks in this fire.

Adjustable Steel Centering.

The accompanying cut shows clearly the construction and mode of operation of the new adjustable steel center of the Adjustable Steel Centering Co., 71 S. Main St., Fond du Lac., Wis.

The photograph was made of a form 36 inches in diameter and 5 feet long, and shows how one section fits into another



AN ADJUSTABLE STEEL CENTER.

and locks automatically. When the hand wheel is turned in one direction the center is collapsed, when turned in another it is reset or a different size is made. The manufacturers say that the center is built for strength, rigidity and faithful service.

The centers are built of any desired length or diameter.

The company will send a pamphlet giving details and price list to any inquirer.

How the Dust Nuisance Can Be Suppressed.

The increased use of automobiles throughout the country has greatly emphasized the dust nuisance.

The average macadam road is neither well built enough nor well kept enough to be dustless under the action of these heavy, rapidly moving vehicles. A good macadam road may be dustless under ordinary traffic, but when the average automobile, weighing as much as a well-laden truck and traveling at thirty or forty miles an hour, passes over it, the road surface will rapidly pulverize into fine, light dust. The nuisance has become such a menace to health and such a cause for discomfort that many so-called remedies have been offered to the public.

Oil has perhaps been most widely used, but it fails to strike at the root of the trouble, inasmuch as it merely attempts to make the dust too heavy to rise, whereas the proper method of procedure would be to prevent the formation of the dust.

During the past two or three years many towns in verious parts of the country have been using most successfully a coal tar preparation manufactured by the Barrett Manufacturing Co, called "Tarvia."

This material prevents the formation of dust, lengthens the life of the roadway, and gives to macadam almost the appearance of asphalt. It is said that a single application will prevent dust for about a pear, at the expiration of which time a second application, at less cost, will have the same result for even a longer period, the cost decreasing and the durability increasing with each successive application. The cost of tarvia is so small as to be more than repaid by the saving in the ordinary expense of well-kept macadam.

The value of this treatment for the prevention of dust was discovered by M. Girardeau, a French road engineer, who happened to notice a spot on a roadway where some tar had been accidentally spilled. The road was preserved longer in the tarred spots than anywhere else and in the course of time wore down around them until the black stains were in high relief. Unlike its effect on the rest of the roadway, the wear of traffic did not pulverize the stone when it was cemented by the tar.

In 1898, it was developed that the tar gave much better results if applied hot, as it is then in a liquid condition, almost like water, and penetrates into the roadway, resulting in a sort of waterproof blanket.

The success of M. Girardeau's experiments led to the use of tar in many departments of France, especially on roads

which were being damaged by automobile traffic, which then gave a new and puzzling problem to road engineers.

At the present time this method of road preservation is in high favor in every department of France. The methods of application have been developed to a fine point, and elaborate machinery has been devised for using tar on roadways. The societies for the suppression of dust have always reported in favor of the tar process, and, in fact, it was anticipated that this use of tar would exhaust the French supply.

In this country the French method was first introduced in 1903, and on good macadam roads gave results which were immediately recognized as highly satisfactory.

The American problem is somewhat different from the French. In France, the care of highways is highly systematized, on account of the military value of proper highways. French road engineers had developed macadam roads to a state of perfection at the time of the coming of the automobile, and they were prompt to meet the new needs which arose with the higher speed and great weight of these vehicles, and their leadership in the use of tar for the preservation of road surfaces is easily understood.

In this country good roads have been until recently less widely appreciated except in the Eastern and Northern States. Fine roads are rare outside the larger cities, but everywhere that macadam is used, as in parkways, boulevards, and the new states, this process will be of the utmost value.

The coming of the automobile has increased the demand for dustless highways and the growth of fine country-places has developed a similar demand for clean roads.

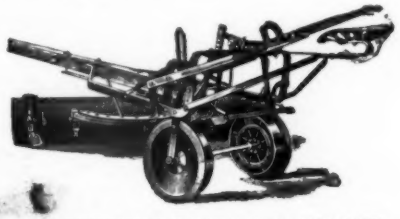
It was found early in the course of the American experiments that ordinary tar would not answer, but that a special preparation was essential. Tarvia is a coal tar preparation that will give the most satisfactory results under American conditions. Up to the present time it has been used on almost a million yards of roadway.

Small Graders Popular.

All over the United States there is springing up a demand for something which will take the place of large, heavy graders for work in small places and in narrow situations. The big machine also demand a large investment and the use of several men and from six to eight horses.

When a machine like the 20th Century Grader made by the Baker Manufacturing Co., Chicago, Ill., is compared with the big machines, road officials, highway commissioners, irrigation farmers, railroad builders and others, find that the daily cost of operation is very materially reduced. In many instances users have found that it saves them at least a third in time and money—not to mention worry and trouble and repairs.

The 20th Century Grader weighs only 600 pounds, and is made entirely of malleable iron and steel. It requires usually only two horses. In a few cases four horses will be needed. One man can handle it. Its convenience in turning and squeezing into small places demonstrates its usefulness. The moldboard is six feet long and is placed at an angle and hung in the center of resistance, so that it makes light draft for the horses and still develops a remarkable amount of cutting power.



THE TWENTIETH CENTURY GRADER.

The new 1908 style has several noticeable improvements. For instance, levers which permit the lifting of the rear end of the blade without the driver leaving his seat. It also has flanged disc wheels. These flanges project two inches beyond the rim, and being sharp they cut into the ground and prevent the grader from sliding.

The Baker Manufacturing Co. have just issued a handsome free booklet in orange and black entitled "20th Century Highways." This book describes up-to-date methods in road making, gives communications from recent users and letters from all classes of officials. It has an insert in the center giving a large half-tone view showing every part of the grader. Every man who is interested in grading of any nature, whether road men, irrigation farmers, paving contractors, road builders, rice planters, etc., should send for this booklet.

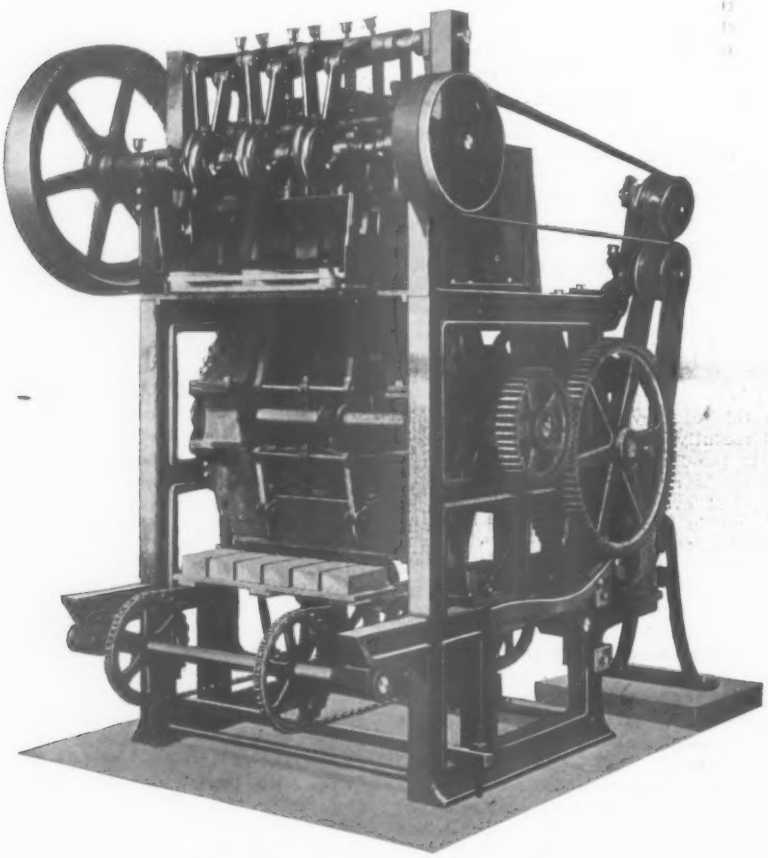
A Power Tamping Concrete Brick Machine.

The Fred C. Hohn concrete brick machine has been in process of development for several years and has now demonstrated its practicability and value so that it is ready for market with evidence of what it can do.

The accompanying cut shows the machine without accessories. The concrete

goes through the machine in the following order:

A continuous concrete mixer is set on the floor by the side of the machine and drops the mixture ready for putting into brick form on an elevating conveyor which in turn drops it into the feed box of the machine. This much of the apparatus is not shown in the cut. The six tampers are shown at the top of the machine. On the platform in front of the tampers will be seen a couple of pallets for the removal of bricks from the machine. Beneath the platform is the revolving frame carrying two sets of brick molds, each making six bricks. As this frame revolves a set of molds is filled with the mixture just before it reaches the top of the circle of revolution. It then passes under the tampers and the cement receives its compression. One of the pallets is automatically drawn from the platform and placed over the set of bricks. The frame then revolves and the set of bricks reaches the bottom of the circle of revolution. The bricks then rest on the pallet and the mold opens enough to let them out safely, by means of the cams and rods seen in the view. The pallet rests on the double chain conveyor shown at the bottom and is carried forward to the position in which the bricks are seen in the view, from which they are removed by hand and placed in racks on a car conveniently placed. The two sets of molds are placed opposite each other on the revolving frame so that one set is being filled and tamped at the time that the other is emptying itself.



THE HOHN CONCRETE BRICK MACHINE.

The whole operation is automatic and continuous, no hand labor being required regularly from the time the concrete materials are put in the mixer feed boxes until the bricks are ready to remove from the machine, except the placing of the pile of pallets on the platform. Nine men on the machine feeding materials, removing and storing brick, keeping the

machine in order and curing the brick can make 20,000 bricks in ten hours, according to the claims of the inventor, and the machine requires ten horse-power to operate. This means a little less than three revolutions a minute of the frame carrying the molds.

In addition to the engine, mixer and brick machine the outfit requires pallets enough for, say, 30,000 brick, cars enough to carry about 1½ days' product and storage and curing capacity for the curing time adopted. The completed bricks are left on the cars on their pallets for 24 hours, when they can be passed on to curing and storage in piles, and this determines the number of cars and pallets required for full operation of the machine.

A. J. Ralph & Co., the general sales agents for the United States, report that much interest is shown in the machine and several sales have already been made, although they have scarcely begun their advertising campaign. They will give full information about cost of outfit, product that can be turned out and probable cost of operation. Their office is at 327 Board of Trade Building, Indianapolis, Ind.

A Safe Meter Box.

The Clark meter box seems to have proved its claims of good appearance, protection of meter from freezing or other injury, perfection of locking device. Imitation is the sincerest flattery, but when it amounts to infringement of patent the compliment is not so fully appreciated and leads to suits for damages, so H. W. Clark says. The original is made by him at Mattoon, Ill.

A Successful Sand Dryer.

The Atlas Dryer Company, of Cleveland, Ohio, announces through a letter that it received from Mr. M. A. Reeb, of Buffalo, N. Y., the success of the Atlas Dryer.

The following is a copy of Mr. Reeb's letter, dated March 25, 1908:

We have thoroughly tested the Atlas dryer, self-contained type, with Atlas stoker, which you furnished us for drying our sand. We liked the principle of the dryer when we first saw it, but were somewhat skeptical as to your ability to construct a cylinder full of holes through its periphery that would not leak. We are glad to admit that we were wrong. The cylinder does not leak.

You have an efficient, economical and mechanically constructed machine, and we like it. We will always be glad to answer inquiries about it and to show it in operation to your inquiring friends.

Trade Publications.

A little directory of Portland cement manufacturers of the United States is issued by C. Earle E. Bottomley, Philadelphia, formerly secretary of the Association of American Portland Cement Manufacturers, for one dollar, which contains the names and address of cement manufacturers, companies and officers, capitalization and brands, and is a convenient vest-pocket reference book for those interested in the manufacturers of cement.

Clifford Richardson, M. Am. Soc. C. E., New York, has printed for circulation an article on "Hysteria in Regard to Pavements," decrying the tendency of the public press to praise some one form of pavement, with change to each novelty as it comes up, usually united with condemnation of other pavements.

"Reactions" is the title of a new quarterly periodical devoted to the science of aluminothermics and published by the Goldschmidt Thermit Co., 90 West St., New York.

The Buyers' Club for the Buyers of America, St. Louis, sends a prospectus of its new building and plan for serving retail buyers and those who wish to show their goods.

The Rudolph S. Blome Company, Unity Building, Chicago, Ill., issue an illustrated booklet with title "Which Pavement Shall We Select?" descriptive of the Blome Company granitoid concrete blocked pavement, the pictures showing pavements laid by them in Gary, Ind., Chicago, Ill., Washington, D. C., Hancock, Calumet, Kalamazoo, Mich., on heavy and light traveled streets, under varying conditions.

The U. S. Geological Survey has issued a report of results of tests at its St. Louis laboratories on Portland cement mortars and their constituent materials which gives much valuable information upon the subject. Data will be abstracted from the report for use in this magazine from time to time whenever applicable.

The Vulcan Tool Manufacturing Co., Quincy, Mass., announces its succession to the business of two old established companies in the same city.

The National Paving Brick Manufacturers' Association, Indianapolis, Ind., has issued a book of forms for carrying through the legal steps for making public improvements by special assessment in Illinois, prepared by A. H. Baer, of Belleville, which should be of great assistance to municipal officials in that state as a pilot through the mazes of its legislation.

The Expanded Metal and Corrugated Bar Co., St. Louis, Mo., keeps its prospective customers informed of its existence by striking postal cards at intervals as well as by judicious advertisements in technical journals.

The Vulcanite Portland Cement Co. has reprinted the article on "Concrete of Exposed Selected Aggregates" which appeared in the January number of MUNICIPAL ENGINEERING in a booklet for general

distribution, bearing the title "An Artistic Concrete Residence."

F. E. Paulson, the energetic sales agent of the Lehigh Portland Cement Co., who makes his headquarters in the Traction Terminal Bldg., Indianapolis, Ind., issues frequent leaflets telling where Lehigh cement is used and how and how much, with a photograph in each to show the appearance.

The March *Concrete Review*, published by the Association of American Portland Cement Manufacturers, Philadelphia, contains theoretical and practical articles on analysis of cements, constituents of mortar and reinforced concrete bungalow and coal pockets. It will be sent on request.

A book of 170 pages on the Venezuelan question, "Castro and the Asphalt Trust," has been issued bearing the name of O. E. Thurber signed to the introduction, in which he states that he was formerly officially connected with companies included in the National Asphalt Co., and is now an official of the A. L. Barber Asphalt Co. The book is largely taken up with reprints of official and semi-official documents pertinent to the case of the New York and Bermudez Company, over which the contest was waged and is intended to show the propriety of the position taken by the Venezuelan government.

Another contribution to the history of the prosecution of the asphalt claims is an article in the *North American Review* by Philip W. Henry, entitled "Has the United States Repudiated International Arbitration?" which has been printed separately for distribution.

The Wm. G. Hartranft Cement Co., Real Estate Bldg., Philadelphia, Pa., send out a number of pertinent reminders of the quality and popularity of Phoenix, Buckhorn and Old Dominion cements, for which they are the sole selling agents.

The Terre Haute Water Company shows its belief in advertising by the liberal space taken in a recent special edition of the *Terre Haute Tribune* and the attractive manner in which the quality and quantity of service are set forth and the facilities for supplying it are illustrated.

The Terre Haute Vitrified Brick Co. also have some space in the special number, for they supply building brick for the trade of Indiana and Illinois mainly but for any part of the field in which excessive freight rates do not overcome the claim of high quality.

The Barber Asphalt Paving Co., Land Title Bldg., Philadelphia, Pa., issue a booklet entitled "History of the Warren Brothers Co., Patent Litigation on the Bitulithic Patents," which contains a letter from Fraley and Paul, their counsel in the cases, giving their statement of the steps in the litigation over Warren patents, claimed to be infringed by pavements which the Barber company had laid at Muskegon and at Owosso, Mich. On Feb. 10, 1908, Judge Swan dismissed the case brought by the Warren Brothers Company at Muskegon for infringement of patents 675,430 and 727,505, and a similar decision in the Owosso case was entered on the same day. It is understood that the cases will be appealed.

The Hydrex Felt and Engineering Co., New York City, is distributing a reprint of a paper by Edward W. DeKnight, its president, before the Boston Society of Civil Engineers on the subject of "Waterproof Engineering," the article first appearing in the December number of the *Journal of the Association of Engineering Societies.*

The March bulletin of the Universal Portland Cement Co. announces that Plant No. 4 at Buffington, Ill., and Plant No. 5 at Universal, Pa., have been completed and are in operation, thus greatly increasing the company's production. The usual pictures of structures in which Universal cement has been used embellish the bulletin.

The story of asphalt is told in a circular issued by the Downard-Lester Rock Asphalt Co., Ardmore, I. T.

The Reinforced Concrete Pipe Co., Jackson, Mich., have issued an elaborate and handsome book on "the most advanced method of sewer construction," showing the manufacture of their reinforced concrete pipe in various cities throughout the United States. A few testimonials follow the pictures and show the satisfactory nature of the product of the company's process. Baltimore, Md., West Allis, Wis., Grand Rapids, Mich., Tomah, Wis., Mobile, Ala., Toledo, O., Knoxville, Tenn., Savannah, Ga., Columbia, S. C., Lancaster, O., Elkhart, Ind., Waukegan, Ill., Wilmington, Del., Denver, Colo., Ford, Mich., Richmond, Ind., Jackson, Mich., Crafton, Pa., Atlantic City, N. J., Michigan City, Ind., are among the cities whose work is illustrated, that at Denver being reinforced concrete water pipe.

Underground Fire Alarm Wires in Bangor.

The annual report of city electrician Cunningham, of Bangor, Me., shows that during the last year 30,000 feet of fire alarm wire has been placed underground, nine old boxes have been changed and two new ones added to the underground system, making a total of seventeen boxes now indicated by red lights. The city electrician recommends that the fire alarm circuits be placed underground wherever the city has underground conduits. He gives considerable credit to the

underground system for the excellent working of the system. He estimates the cost of putting the remaining boxes where the city nas conduits underground at about $1,500.

Trade Notes.

ASPHALT.

Indianapolis, Ind.—The contract for a new municipal asphalt paving plant was awarded, Mar. 13, to Hetherington & Berner, of this city, for $15,625.

Bellingham, Wash.—The Independent Asphalt Co. will erect an asphalt plant on the water front, at a cost of $20,000.

El Paso, Tex.—The reorganization of the Bitulithic Paving Company is contemplated by a number of business men of this city and President Carlton H. Wells and W. J. Rand, of the bitulithic company.

CEMENT.

Sandusky, O.—Special. The White Portland cement made by the Sandusky Portland Cement Co., Sandusky, O., has been specified for the exterior finish of the Southern Pacific Hospital at San Francisco, also the interior finish and for pointing the stone work on the new bank building at San Jose, Cal., and for swimming pool in mosaic work at Atlantic City, N. J.

The Sandusky Portland Cement Co., Sandusky, O., manufacturers of Medusa Water-proof Compound, report it specified by the Bureau of American Republics. This is one of the highest compliments that can be paid to the quality of any product. The material has recently been used successfully in the following work: Concrete water tanks Gloekler Bldg., Pittsburg, Pa.; basement walls Joplin Hotel, Joplin, Mo.; Third National Bank Bldg., St. Louis, Mo.; U. S. Navy Yard, Puget Sound, Wash.; Lynn Haven Hotel, Norfolk, Va.; Cleveland Concrete Building Block Co., Cleveland O., in their entire output; Orgeon Short Line construction, Salt Lake, Utah; Oswego Falls Paper Co., Fulton, N. Y.; G. & T. Earle Co., contracts, Wilmington, England; Armour & Co., construction, Chicago, Ill.

Chamberlain, S. D.—The Dakota Portland Cement Co. has secured a site here and will construct cement plant with a capacity of 2,000 barrels a day.

Three Forks, Mont.—The Three Forks Cement Co. has commenced the construction of a cement plant at the new location, to be known as Trident. The plant will probably be completed before the last of the year.

Los Angeles, Cal.—Aman Moore, president of the Cement Engineering Co., is interested in the organization of the Tehachapi Portland Cement Company. The company is not yet ready to make its plan of organization known to the public.

Martinsburg, W. Va.—A company will be incorporated to establish a Portland cement plant near here, by J. W. Ivery, Dillsburg, Pa.; John T. Morris, Orange, N. J.; Philip Herman, Latrobe, Pa.; B. A. Waltman and Philip Hake, York, Pa. Plans and estimates for the plans have been approved.

St. Louis, Mo.—The Meramec Portland Cement & Material Co., with offices in the National Bank of Commerce Bldg., this city, has secured options on land at Sherman, Mo., and a cement plant will be constructed.

CONCRETE BLOCKS.

Manitowoc, Wis.—G. B. Schumacher and Martin Georgeson have formed a partnership, to be known as the Schumacher-Georgeson Cement Works, and will make cement blocks, tile and sewer pipe.

Grand Rapids, Minn.—John Lofberg has purchased the cement block manufacturing plant of Frank Freeslone and will continue the business.

Mankato, Minn.—D. Radichel, who is operating a cement tile plant at Lake Crystal, Minn., contemplates locating here.

Le Mars, Ia.—Barney Kramer is having a cement block plant constructed here.

Cantril, Ia.—E. S. Leonard and J. L. Roberts contemplate establishing a concrete plant here.

Rinard, Ia.—The Rinard Concrete Co. has been incorporated by L. W. Moody, president; Theo. Dangerfield, vice-president; Will E. Dangerfield, manager and treasurer, all of Pomeroy; E. L. Crawford, secretary, of this city.

Torah, Minn.—Joseph Vogt will manufacture cement bricks.

Forest River, N. D.—Pete Yeo has begun the manufacture of cement blocks.

Marion, O.—The Hydraulic Concrete Block Co. has been incorporated by H. C., Martha A., and Frank F. King and W. C. and Myrtle O. King.

Omaha, Neb.—The Wilson Reinforced Concrete Co. has been incorporated by Chas. H. Busch, John H. Busch, Chas. H. Wilson, Trenmore Cone and John Gilligan.

Newark, N. J.—Wittel Bros. have been incorporated to manufacture concrete biulding blocks, building materials, etc., by Andrew P. Wittel, 637 Bergen st.; Herman A. Wittel, 43 Peshine ave.; William Fuss, 62 16th ave.

Baltimore, Md.—The Baltimore & Washington Concrete Co. has been incorporated to manufacture concrete for pavements, etc.

Nashville, Tenn.—Joseph H. Peter & Co. will install a plant for the manufacture of artificial stone.

St. Joseph, Mo.—The St. Joseph Cement Block & Burial Vault Co. has been incorporated by A. O. Ozenberger, W. H. Jones and J. S. Ozenberger.

PURCHASE OF MACHINERY.

Markle, Ind.—Special. W. M. Allen desires catalogues of mixers for general purposes.

LIGHT, HEAT AND POWER.

Chicago, Ill.—The Watson Electric Co. is being organized here to manufacture electrical supplies and apparatus, by Robert H. Watson, Frank G. Watson, and Milton O. Naramore.

Chicago, Ill.—The Chicago Electric Meter Co. is being organized to handle electrical meters, by M. J. Dunbaugh, L. E. Wing and C. C. Madison.

Rockford, Ill.—The Gas & Electrical Device Co. is being organized to manufacture and sell gas and electrical devices, by T. W. Pitcher, C. Carson and R. F. Locke.

MISCELLANEOUS.

Jersey City, N. J.—The National Valve Co. has been incorporated to manufacture valves, by Chas. A. Parks, Wilmer M. Carry and Alan P. Smith, Jr.

Camden, N. J.—The Juniata Paving Co. has been incorporated to do all kinds of street paving, by Frank R. Hansell, Wm. T. Elder and John A. McPeake.

IMPROVEMENT AND CONTRACTING NEWS

PAVING.

CONTEMPLATED WORK.

Ashland, Ore.—Bitulithic or asphalt paving is contemplated.

Rock Island, Ill.—Brick paving is contemplated for 9th st.

Oshkosh, Wis.—Asphalt paving contemplated for Oakland ave.

Scio, O.—Plans are being prepared for paving 1½ mi. of streets.

Roswell, N. Mex.—Plans are being prepared for street improvements.

Norman, Ill.—The question of improving the streets is being agitated.

Barberton, O.—Paving is contemplated for Lake ave. and Wooster road.

Lorain, O.—Plans are being prepared for macadamizing North Ridge road.

Winnipeg, Man.—Asphalt paving is proposed for Main st. and Wiggins ave.

Salem, Ore.—About 11 blocks of Commercial st. will be paved with bithulithic.

Topeka, Kas.—Plans are being prepared for brick paving. C. B. Burge, cy. clk.

Springfield, Mo.—A resolution has been introduced for paving E. Elm st. with brick.

Cleveland, O.—About 20 mis. of sidewalks will be laid in this city during 1909.

Plymouth, Mich.—This city voted to issue bonds for paving. Fred Bennett, prest.

Hazelton, Pa.—Ordinances have been passed for paving Church and N. Wyoming sts. with brick.

Park City, Tenn.—Will vote May 15 on issue of bonds for street improvements, sewers, etc.

Evansville, Ind.—Bids will be asked about April 1 for paving. Jas. D. Saunders, cy. engr.

Scranton, Pa.—Council has passed ordinances providing for paving Green Ridge st. and Quincy ave.

Detroit, Mich.—A resolution has been passed providing for the paving of Palmer ave. with asphalt.

Abilene, Kas.—This city contemplates constructing about 10 blocks of brick paving. J. A. Graves, cy. clk.

Utica, N. Y.—The paving of Water, Burnett, Parker and Walker sts. and Jefferson ave. is contemplated.

Bucyrus, O.—Petitions have been submitted to city council asking for the paving of 3 blocks of streets.

Decatur, Ill.—Bids will be asked about April 11 for improving sundry streets. A. B. Alexander, cy. engr.

Hartford, Conn.—The state highway commissioner has received plans for the improvement of a number of roads.

Jefferson City, Mo.—Plans for about 1-mi. of brick paving are being prepared by E. F. C. Harding, cy. eng.

Hartford, Conn.—An appropriation of $345,050 for street improvements has been recommended by the board of finance.

Edmonton, Alta.—The rate payers voted to raise an additional $130,000 for the construction and paving of streets.

Lynchburg, Va.—A resolution has been passed providing for an appropriation of $10,000 for constructing sidewalks.

Atlanta, Ga.—A resolution has been passed for paving portions of Forsyth and Alabama sts. with creosoted blocks.

Ft. Wayne, Ind.—Asphalt paving is contemplated for E. Columbia st. and brick for Taylor st. F. M. Randall, cy. engr.

Mexico, Mo.—Plans for ½-mi. of brick paving are being prepared and bids will be asked soon. L. L. Winan, cy. engr.

Sigourney, Ia.—Paving is contemplated for the streets in the residence districts running north, south, east and west.

Morocco, Ind.—The county commissioners will ask for bids soon for constructing 5-mis. of stone road in McClelland and Colfax twps.

Lansing, Mich.—Council has decided to pave Washiigton ave. S. with brick, asphalt filled, on concrete base. Cy. engr. Collar.

Boone, Ia.—Bids will be asked about April 1 for about 2-mis. of Portland cement curbing and 24-in. gutter. K. C. Kastberg, cy. engr.

Hamilton, Ont.—The civic public works department has decided upon expending $250,000 on permanent road building. W. R. Leckie, clk.

Baltimore, Md.—Plans have been completed for grading and paving North ave. from Payson to 12th sts. A. E. Christhilf, ch. engr. comrs.

Newark, N. J.—Ordinances are pending providing for brick and granite block paving in a number of streets. Wm. E. Greathead, clk. bd. wks.

Mt. Vernon, Ind.—Resolutions have been passed providing for rock paving in W. 9th, James, Vine, Wolfin and Pearl sts. Cy. engr. Sarlls.

Hanover, Pa.—Louis Shultz, W. Clinton Shultz and Edgar D. Bortner have been appointed a committee to secure paving for the public square.

Oakland, Cal.—Ordinances have been passed providing for the paving of 17th, Lawton and Shafter aves. with macadam, and 10th st. with asphalt.

Newport, Ky.—The improvement committee has recommended brick paving for Theele alley, German, Putnam, Lindsey and a number of other streets.

Crawfordsville, Ind.—Action on resolutions for paving Grant ave., Walnut, Water, W. Pike and College sts. with brick has been postponed until June 8.

Mt. Carmel, Ill.—Bids will be asked about April 1 for paving. In addition to this about 5-mis. of paving is contemplated. Guy W. Courter, cy. engr.

Manhattan, Kas.—This city contemplates the construction of 26 blocks of cement sidewalk and 24,000-ft. of curb and gutter. H. W. Hungerford, cy. clk.

Wallace, Idaho.—Paving is contemplated for a number of blocks of business streets this spring. The material has not been decided upon, but Mayor Toole is said to favor asphalt.

Haverhill, Mass.—Mayor Wood has signed an order providing for a bond issue of $48,000, of which $35,000 will be used for repairing 16-mis. of macadam roads, and $5,000 for constructing sidewalks.

Salina, Kas.—Special. G. Wakenhut, cy. engr., says bids will be asked for about 45,000-sq. yds. of brick, asphalt and bitulithic paving in Santa Fe ave., Walnut, Ash, Elm, 7th and 5th sts.

Junction City, Kas.—This city contemplates the construction of 2 blocks of brick paving and 1 block of concrete curb and gutter, and bids will be asked about April 1. W. W. Pease, cy. clk.

Connersville, Ind.—Plans have been completed and bids will be asked soon for grading W. 5th and Oak sts. and building cement sidewalks in Grand ave. and 3d st. hill. Jacob S. Clouds, cy. clk.

Ashtabula, O.—City council has ordered plans and specifications prepared for paving Ruth st. its entire length, and has voted to change the material for paving Davidson st. from asphalt block to vitrified brick. L. A. Amsden, cy. engr.

Newark, N. J.—Ordinances have passed a second reading for paving Hermon st., from Chestnut to Thomas sts., and Komorn st. from Hamburg Place to St. Charles st., with bituminous concrete on 6-in. concrete foundation. Wm. E. Greathead, clk. bd. of wks.

Dayton, O.—The city engineer has made estimates of the cost of paving, as follows: Monument ave., plain macadam, $29,173; creosoted wood block, $57,013; Wayne ave., plain macadam, $29,814; creosoted wood block, $52,956; Meigs st., macadam cement, $5,761; wood block, $10,321.

CONTRACTS TO BE LET.

Fork, Minn.—Bids are asked until May 1 for constructing 5-mis. of roads. J. P. Lein, twp. clk.

Wahpeton, N. D.—Bids are asked until April 6 for constructing sidewalks. Wm. R. Purdon, cy. audt.

Columbus, Ind.—Bids are asked until April 6 for constructing 3-mis. of gravel road. Co. comrs.

Rushville, Ind.—Bids are asked until April 7 for improving a highway. A. L. Emship, co. audt.

Reno, Nev.—Bids are asked until April 13 for paving 4 streets with asphalt. H. E. Christie, cy. clk.

Mahwah, N. J.—Bids are asked until April 4 for constructing stone roads. Chas. E. Schneider, twp. clk.

Waterbury, Conn.—Bids are asked until April 7 for grading Clark st. R. A. Cairns, cy. engr.

Lafayette, Ind.—Bids are asked until April 8 for constructing 6,000-ft. of gravel road. Co. comrs.

Madison, Ind.—Bids are asked until G. Crozier, co. audt.

Indianapolis, Ind.—Bids are asked until April 6 for constructing 12,000-ft. of gravel road near Lawrence. Co. comrs.

Covington, Ind.—Bids are asked until April 7 for constructing 3 gravel roads. W. P. Gray, co. audt.

Grand Forks, N. D.—Bids are asked until April 3 for constructing sidewalks. W. V. O'Connor, cy. audt.

Brownstown, Ind.—Bids are asked until April 7 for constructing 6 gravel roads. H. H. Wacker, co. audt.

Danville, Ind.—Bids are asked until April 6 for constructing Ewing macadam road. Wm. H. Nichols, co. audt.

Jamestown, N. D.—Bids are asked until April 6 for sidewalk work for a year. John G. Bensch, cy. audt.

Devils Lake, N. D.—Bids are asked until April 6 for constructing tile and soft sidewalks. Ole Skratass, cy. clk.

Natchez, Miss.—Bids are asked until April 6 for constructing a drain and fill on Washington road. John F. Jenkins, clk.

Hohokus, N. J.—Bids are asked until April 4 for constructing 1.65-mi. of stone road. R. Wanamaker, engr.

Richmond, Ind.—Bids are asked until April 6 for constructing 3-mis. of gravel road. Demas S. Coe, co. audt.

Enderlin, N. D.—Bids are asked until April 6 for constructing cement sidewalks. E. T. Danielson, cy. audt.

Troy, O.—Bids are asked until April 3 for constructing a macadam road. E. E. Parson, co. audt.

Vincennes, Ind.—Bids are asked until April 7 for constructing 17,976-ft. of gravel road. John T. Scott, co. audt.

Bedford, Ind.—Bids are asked until April 7 for constructing 8½-mis. of gravel roads. Walter G. Owens, co. audt.

Frankfort, Ind.—Bids are asked until April 7 for constructing 30-mis. of gravel roads. Chas. F. Cromwell, co. aud.

Cincinnati, O.—Bids are asked until April 17 for improving Miami River road, Whitewater twp. Fred Drehis, co. clk.

Vernon, Ind.—Sealed bids are asked until April 6 for constructing 2½-mis. of pike road. J. A. Deputy, chmn. co. comrs.

Hartford City, Ind.—Bids are asked until April 6 for constructing gravel and rock roads. L. W. Daugherty, co. audt.

Bloomfield, N. J.—Sealed bids are asked until April 7 for furnishing 2,000-tons of broken stone. Wm. L. Johnson, town clk.

Lawrenceburg, Ind.—Bids are asked until April 6 for grading, draining and paving 12,084-ft. of road. Wm. S. Fagaby, co. audt.

Jefferson, Wis.—Sealed bids are asked until April 9 for constructing cement walks and crossings during 1908. John J. Spangler, cy. clk.

Delphi, Ind.—Bids are asked until April 6 for constructing 11-mis. of gravel road in Burlington twp. M. G. Haun, co. audt.

Zanesville, Ind.—Bids are asked until April 6 for paving and curbing 9th st., from Main to Marietta. J. T. Hahn, clk. B. P. S.

Hartford City, Ind.—Bids are asked until April 6 for constructing 11,370-ft. of gravel and macadam road. L. W. Dougherty, co. audt.

Anna, Ill.—Bids are asked until May 1 for constructing 24,758-sq. yds. of brick paving. C. W. Brown, cons. engr., Jacksonville, Ill.

Ocala, Fla.—Sealed bids are asked until April 8 for constructing a hard surface or macadamized road. S. T. Sistrunk, co. clk.

Fargo, N. D.—Sealed bids are asked until April 6 for constructing sidewalks during the ensuing year. N. C. Morgan, cy. audt.

Primghar, Ia.—Sealed bids are asked until April 6 for road work during 1908. M. L. Blanchard, chm. trustees of Center twp.

La Moure, N. D.—Sealed bids are asked until April 6 for constructing sidewalks and street crossings. C. M. Holbert, cy. audt.

Hillsboro, N. D.—Bids are asked until April 6 for constructing incombustible sidewalks and crossings. O. K. Lee, co. audt.

Olympia, Wash.—Sealed bids are asked until April 10 for grading and macadamizing state aid roads Nos. 8, 9 and 11. State highway bd.

Knox, Ind.—Sealed bids are asked until April 6 for grading and paving with stone or gravel several roads. Lee M. Ransbottom, co. audt.

Richwood, O.—Bids are asked until April 4 for paving Franklin st. and Conboy alley with vitrified brick, curbing, etc. R. L. Gordon, vil. clk.

Jasper, Ind.—Sealed bids are asked un-

til April 7 for constructing 4-mis. of free turnpike road upon certain highways. M. A. Sweeney, co. audt.

Martinsville, Ind.—Sealed bids are asked until April 7 for constructing highway improvements in Jackson and Brown twps. B. E. Thornburg, co. audt.

Chehalis, Wash.—Bids are asked until April 20 for paving 9 blocks of streets with brick, asphalt, hassam, bitulithic or other material.

Dillon, Mont.—Sealed bids are asked until April 6 for completing a county road from Ames' place to west side of top of divide. John S. Baker, co. clk.

Kokomo, Ind.—Bids are asked until April 15 for grading, constructing culverts and draining a highway between Howard and Miami counties. Wm. L. Benson, co. audt.

Topeka, Kas.—Bids are asked until April 10 for 10 blocks of new paving and curbing and 13 blocks of repaving on present concrete foundation. C. B. Burge, cy. clk.

Salem, N. J.—Bids are asked until April 14 for constructing 3.2-mis. of Penn's Grove and Dancer's Mill road. J. F. Ayres, dir. bd. freeholders.

Washington, D. C.—Bids are asked until April 4 for constructing macadam roads, concrete walks, etc., at General Hospital Reservation. Capt. H. L. Pettus, Q. M.

Vicksburg, Miss.—Bids are asked until April 9 for grading and graveling road No. 132 from limits of Speed's addition to Confederate ave. J. D. Laughlin, clk. bd. supvrs.

Janesville, Wis.—Sealed bids are asked until April 10 for constructing 4,182-sq. yds. of brick paving in E. Milwaukee st. and Lincoln School alley. S. B. Heddles, chm. st. assessment com.

Grand Rapids, Mich.—Sealed bids are asked until April 2 for grading and paving with asphalt or bituminous macadam N. Lafayette st. Chas. M. Wilson, prest. B. P. W.

Sweetwater, Tenn.—Sealed bids are asked until April 10 for grading, macadamizing and constructing concrete sidewalks, curb and gutter on approximately 2-mis. of streets. T. Jones, mayor.

San Salvador, San Salvador, C. A.—Bids are asked until May 1 for paving certain streets with natural or artificial stone, with asphalt joints, measuring 18,586 meters. Ernest Schernikow, Consul, 42 Broadway, N. Y. City.

Troy, Ill.—Sealed bids are asked until April 6 for lowering and grading streets and removing 5,000-cu. yds. of earth for a distance of from 200 to 2,500-ft. Dr. F. W. Braner, mayor.

Rutherford, N. J.—Sealed bids are asked until 8 p. m. April 3 for laying and relaying bluestone flagging, cross walks and cross gutters, setting and resetting bluestone curb and cobble gutter, bluestone curb and cement gutter, constructing concrete and cement sidewalk, constructing concrete and cement curb and gutter, laying and relaying cobbles, etc. F. A. Stedman, boro clk.

Harvey, Ill.—Sealed bids are asked until April 3 for constructing 10,953-sq. yds. of vitrified brick paving; 1,800-cu. yds. of grading; 8,160-lin. ft. of concrete curb and gutter; 10,953-sq. yds. of crushed limestone foundation; 10,953-sq. yds. of sand cushion; adjustment of sewers, catch basins and manholes; 12 new catch basins; 40 c. i. crossing plates; 240-lin. ft. oak plank headers. E. N. Flewelling, chm. bd. local impvts.

CONTRACTS AWARDED.

Portsmouth, O.—Kelly Bros. secured the contract for street paving, for $4,186.

Seattle, Wash.—The contract for paving Yesler way was awarded to P. J. McHugh, for $95,333.

Iola, Kas.—The contract for constructing 7 blocks of brick paving was awarded to R. S. Gilfillan.

Peoria, Ill.—The contract for paving Lincoln ave. was awarded to the D. A. Myers Co., for $6,987.

Freehold, N. J.—The contract for constructing 3-mis. of gravel road was awarded to Richard Hafeman, Mar. 11.

South Omaha, Neb.—The National Construction Co. has been awarded the contract for paving W. Q and 25th sts.

Benton Harbor, Mich.—The contract for paving Main st. was awarded to Worth Bean, Jr., of this city.

Ottawa, Ill.—The contract for the east side paving was awarded to H. L. Hossack, of this city, for $82,509.10.

Manalapan, N. J.—The contract for constructing a stone road here was awarded to G. Orr, of this place, for $2,781.

Lima, O.—The contract for paving N. and S. Elizabeth sts. was awarded to the Andrews Asphalt Co., for $12,000.

Fayetteville, Tenn.—The contract for constructing 5-mis. of concrete pavement was awarded to Ramsey & Davis, of Portland, Ind.

Cedar Rapids, Ia.—The contract for 20,000-sq. yds. of asphalt paving was awarded to the McCarthy Improvement Co., for about $40,000.

Farmingdale, N. J.—The contract for constructing the Farmingdale-Hamilton gravel road was awarded to Richard Hafeman, of Farmingdale.

San Francisco, Cal.—The contract for repaving Market-st. was awarded to the Barber Asphalt Paving Co., Rialto Bldg., for $19,350.

St. Paul, Minn.—The contract for resurfacing Oakland ave. with asphalt was awarded to the Barber Asphalt Paving Co. for $19,085.

Columbia City, Ind.—The contract for paving Main and Market sts. was awarded to the Moellering Construction Co., of Ft. Wayne, for $58,798.32.

Waterloo, Ia.—The contract for brick paving was awarded to Mike Ford, of Cedar Rapids, and for asphalt paving to P. F. McCarthy, of Davenport.

Sharon, Pa.—The contract for paving S. Main, S. Irvine and S. Dock sts. with vitrified brick was awarded to Wm. McIntyre Sons, for $40,000.

Augusta, Ga.—Contracts have been awarded as follows: Paving and curbing, Wm. Howe, $15,000; constructing culvert over canal, T. O. Brown, $1,500.

Vicksburg, Miss.—The contract for repairing the roadway leading to the National Cemetery, was awarded to H. F. Garlish, of this city, for $9,750.

Vincennes, Ind.—The contract for constructing granolithic sidewalks for the U. S. public building here has been awarded to Pennington & Norton.

Gloucester, N. J.—The contract for macadamizing streets and constructing sewers was awarded to B. F. Sweeton, Edward J. O'Mara and B. F. Shanley.

Cambridge, O.—The contract for paving N. 8th and Long sts. and Madison ave. with brick was awarded to Porter E. Gibbons, of this city, for $15,700.

Appleton, Wis.—The contract for laying 8 blocks of creosoted block paving has been awarded to Fielding & Shepley, of St. Paul, Minn., for about $45,000.

Clinton, Ia.—The contract for constructing paving, curbing and guttering in 4th ave. was awarded to the O'Farrell Contracting Co., of Dubuque, for $5,105.

Lake Charles, La.—The contract for constructing 3-mis. of cement sidewalk in

Hodges and Ryan sts. was awarded to the West Construction Co., of Nashville, Tenn.

Neenah, Wis.—The contract for paving Wisconsin ave. was awarded to J. Rasmussen & Sons, of Oshkosh, as follows: Paving, $1.86 a sq. yd.; street car portion, $3.15.

Middletown, O.—The contract for paving the Yankee road and a part of 4th st. with asphalt was awarded to the Andrews Asphalt Co., of Hamilton, O., at $2.10 a sq. yd.

Portland, Ore.—This city has awarded contracts for street improvements, as follows: Clackamas st., $4,251, and Albina st., $11,811, Star Sand Co.; Denver ave., Miller & Bauer, $3,469.

Toledo, O.—Contracts for constructing 200,000-sq. ft. of sidewalks were awarded Mar. 10, as follows: Concrete sidewalks, Jas. H. Horan, $6,321.39; stone flagging, W. W. Hummel, $17,743.46.

Fort Worth, Tex.—The Texas Bitulithic Co. has been awarded a contract for 114,000-sq. yds. of paving, for $240,000. The contract calls for 114,000-sq. yds of brick or bitulithic paving.

Hollywood, Cal.—The contract for macadamizing the east and center sections of Sunset boulevard was awarded to P. A. Howard for $67,450, and for the west section to J. N. Patillo, for $47,515.

Riverhead, L. I., N. Y.—The contract for constructing a stone road from this place to the Quogue depot was awarded to the Robertson & Gerehart Cement Co., 18th ave., Brooklyn, for $66,097.

Leavenworth, Kas.—O. C. Chapin was awarded the contract for paving Kiowa st. with brick at $1.44 a sq. yd. for brick paving; 37 cts. a cu. yd. for grading; $30 per 1,000 for white oak headers; $1 for expansion joints.

Davenport, Ia.—The contract for paving Howell st. between 4th st. and Rockingham road was awarded to the McCarthy Improvement Co., as follows: Excavating, 35 cts. a cu. yd.; paving, $1.45 a sq. yd.; curbing, 32 cts. a lin. ft.

Peoria, Ill.—A contract for paving 1st ave. from Spencer to 7th, with brick, was awarded to the Crescent Constructing Co. for $20,656. The A. D. Thompson construction Co. was awarded the contract for paving Kenzie st. with brick for $1,945.10.

Denver, Colo.—The contract for paving Blake st. was awarded, Mar. 5, to the Denver & Pueblo Construction Co., for $11,742. The Commonwealth Construction Co. secured the contract for paving the alley on both sides of Colfax st., for $11,742.

Leavenworth, Ind.—The contract for paving the east and west alley in block 69 was awarded to James Stanton, at $1.51 a sq. yd. for paving, 31 cts. a cu. yd. for grading, $29 per thousand for white oak headers, and 50 cts. each for expansion joints.

Cortland, N. Y.—The Barber Asphalt Paving Co. was awarded contracts for paving N. Main st. and Homer ave. as follows: Homer ave., asphalt, 10-yr. guarantee, stone curb, $23,254; N. Main st., asphalt, 10-yr. guarantee, sandstone curb, $20,538.

Louisville, Ky.—Contracts have been awarded as follows: Grading, curbing and paving 2 streets with vitrified brick, Henry Bickel Co., 1052 Garden st., $1.72 a sq. yd.; grading, curbing and paving 2 streets with vitrified brick, L. R. Figg, 243 6th st., $1.61 a sq. yd.; grading, curbing and paving 9 alleys with vitrified brick, C. W. McFarland & Co., $1.48 to $1.56 a sq. yd.

Minneapolis, Minn.—Contracts were awarded, Mar. 13, as follows: Purington Paving Brick Co., Galesburg, Ill., 40,000 sq. yds. paving blocks at 96 8-10 cts. per sq. yd., f. o. b. cars, Minneapolis. Kettle River Quarry Co., Minneapolis, Minn., 40,000 sq. yds. sandstone paving blocks at $1.55 per sq. yd., f. o. b. cars, Minneapolis. Robert Graham, St. Cloud, Minn., 2,000 lin. ft. of 5x20 granite curb at 57 cts. for straight and 67 cts. for radius curb, f. o. b. cars, Minneapolis. Wilson Granite Co., Chicago, Ill., 2,000 cu. yds. crushed granite, at $2.07 per cu. yd., f. o. b. cars, Minneapolis.

Seattle, Wash.—Contracts for grading and constructing concrete sidewalks have been awarded as follows: 24th ave. and other streets, grading and constructing concrete sidewalks, Josiah Jones & Son, $9,577. 19th ave. Northwest, grading, W. F. Manney & Co., $4,883. 20th ave. Northeast and other streets, grading, Macquaid & Moore, $4,023. Grand Boulevard, grading, Mougin & Price, $1,608. E. Mercer st., concrete sidewalks, Paul Steenstrup, $5,258. Florence Court and other streets, T. Ryan, $21,811. 36th ave. North and other streets, grading, Rich-Harrison Construction Co., $6,133.

SEWERS.

Madison, Wis.—With a view to improving the sewage disposal system of the cities of the state, Prof. J. G. Davis, of the hydraulic department of the College of Engineering, and Jas. T. Bowles, are conducting tests.

Trenton, N. J.—A bill has been passed which validates the construction of sewers in fourth class cities.

CONTEMPLATED WORK.

Valley Junction, Ia.—A sewerage system is contemplated.

Jefferson, Wis.—Plans for a sewerage system are being devised.

Mountain Home, Idaho.—This city is planning to install a sewerage system.

Atlanta, Ga.—Council has authorized the construction of sewers in 17 streets.

Prescott, Ark.—The construction of a sewerage system is again contemplated.

Miles City, Mont.—The sewerage system may be extended to the Yellowstone.

Bordentown, N. J.—City council is planning to construct a sewerage system.

Caldwell, N. J.—Estimates are being prepared for constructing a sewerage system.

Martinsville, Ind.—Plans for constructing a sewer in Jackson st. are being prepared.

Knightstown, Ind.—The town council has voted to constructed 2-mis. of sanitary sewers.

Selma, Cal.—The estimated cost of constructing a sewerage system here is $49,579.

Canton, Ill.—C. R. Beam, cy. engr., urges the necessity of constructing more sewers.

Heuvelton, N. Y.—The question of constructing a sewerage system is being agitated.

Elgin, Ill.—The estimated cost of the proposed sewer system in the Sixth ward is $103,408.

Silvis, Ill.—A septic tank is proposed to take care of the sewage of this village.

Aberdeen, S. D.—The question of constructing additional sewers is under consideration.

Bremerton, Wash.—Plans are being prepared for constructing a sewer system in Dock st.

Pasadena, Cal.—This city has voted to issue $50,000 bonds for the improvement of sewers.

Laurel, Md.—A bill has been passed providing for the construction of a sewerage system here.

Vicksburg, Miss.—This city will issue $250,000 bonds for constructing a sewerage system.

Gibson City, Ill.—The citizens are opposed to paving First st. before sewers are built.

Rio Vista, Cal.—Plans have been authorized for constructing a sewerage system. Town trustees.

Waupaca, Wis.—This city will vote on the issue of bonds for constructing a sewer and septic tank.

Athens, Ga.—This city will vote April 15 on the issue of $40,000 for extension of sewerage system.

Burlington, N. C.—Bonds have been issued for constructing a sewerage system. W. E. Sprague, mayor.

Joliet, Ill.—Bids will probably be asked soon for constructing sewers and water mains in the Seventh ward.

Princeton, Ind.—An ordinance has been adopted providing for the construction of a sewerage system.

West Bend, Wis.—Plans and specifications for a sewerage system will be prepared by W. G. Kirchoffer.

Chenoa, Ill.—The question of constructing a better and more adequate sewerage system is being discussed.

Cambridge, O.—Plans are being prepared for constructing sanitary sewers in Campbell and Woodlawn aves.

Jeffersonville, Ind.—Plans for constructing a sewerage system are being prepared by Victor W. Lyon, cy. engr.

Lewistown, Ill.—The question of constructing a sewer in Main st. is under consideration. Mayor Duvall.

Taylorville, Ill.—An ordinance has been passed providing for the construction of a sewer in Shawnee district.

Jefferson City, Mo.—Plans for sewers in three districts are being prepared by E. F. C. Harding, cy. engr.

Ashtabula, O.—Council has approved plans for constructing a sewer in W. Prospect st. L. A. Amsden, cy. engr.

Hutchinson, Kas.—The question of constructing a sewerage system is under discussion here. E. Metz, cy. clk.

Moorhead, Minn.—The construction of a trunk sewer in Outlet Dist. No. 3, and a few lateral sewers, is contemplated.

Akron, O.—The improvement of the main sewer emptying into Cuyahoga river is proposed, at an expenditure of $5,000.

Easton, Md.—The question of issuing $40,000 bonds for the construction of a sewerage system will be voted on April 2.

Monroe, Mich.—The question of issuing $12,000 bonds for constructing a trunk sewer in Elm ave. will be voted on in April.

Bloomington, Ind.—A resolution was adopted Mar. 19 providing for the construction of a sewerage system in this city.

Knoxville, Tenn.—Surveys for the extension of the First Creek sewer main are being made by S. D. Newton, cy. engr.

Davenport, Ia.—Surveys for the construction of a sewer in the west end have been completed by the city engineer.

Omaha, Neb.—The question of constructing a sewer in Mason st., from 16th to 21st, is under discussion.

Palouse, Wash.—This city contemplates engaging a competent engineer to make plans for a sewerage system.

Andalusia, Ala.—Bids will be asked soon for constructing 1¾-mis. of sanitary sewers. Address Prof. Pace.

Clarion, Ia.—The county board will hold a hearing April 6 on the establishment of a drainage district in Belmond.

Lawrence, Mass.—An ordinance has been passed to construct a brick and pipe sewer in Ward 1. John C. Needham, supt. sts.

Newark, N. J.—Bids will be asked for soon for constructing about 7,000 ft. of concrete sewers. Edwin S. Rankin, ch. engr. sewer dept.

Yeadon, Pa.—Plans for a sewage purification plant, including septic tanks and filter beds, will be prepared. Albert S. Demon, boro engr.

Watseka, Ill.—Plans and specifications are being prepared for constructing 24-in. vitrified pipe sewers on the east side. C. E. Matkin, cy. clk.

Muncie, Ind.—City engineer Potter has been directed to prepare plans and specifications for constructing a general sewer system in Kilgore ave.

Dubuque, Ia.—The construction of 975-ft. of 8-in. tile pipe sewers and 6 manholes in Alta Vista st. is contemplated. Edmund A. Linehan, cy. recdr.

Mt. Carmel, Ill.—Bids will probably be asked during April for constructing about one-half of the proposed sewerage system here. Guy W. Courter, cy. engr.

Neenah, Wis.—The bd. of pub. wks. has acted favorably on the recommendation to construct sewers in Maple, Union and Pine sts. and 2nd and Washington aves.

Newark, N. J.—Ordinances have been approved for constructing sewers in Lockwood and Lafayette sts. and Elizabeth and Jelliff aves. Wm. E. Greathead, clk. bd. of wks.

Columbus, O.—The council committee on finance has approved an ordinance providing for the issue of $75,000 bonds for constructing a sanitary sewer in Sullivant ave.

Mt. Vernon, Ind.—The construction of a large brick sewer 4½-ft. in diameter, from 5th and Canal sts. to McFaddin creek, in the east end of the city as the terminus, is contemplated.

Woodlawn, Pa.—The state health commissioner has notified the Jones & Laughlin Steel Co., of Pittsburg, to have plans prepared for constructing a sewerage system and disposal plant.

Exeter, N. H.—The citizens have voted to extend the sewerage system, including the construction of sewers in High, Park, Washington and other streets. John M. Wadleigh, chmn. selectmen.

Sandusky, O.—Plans have been completed for constructing a sewer in Farwell st., including the following: 2,100-ft. 20x40-in., 2,300-ft. 20x30-in. and 2,600-ft. 24x18-in. concrete sewer; 2,200-ft. 18-in. and 1,700-ft. 15 and 12-in. vitrified pipe sewer.

Allentown, Pa.—City engineer Weirbach has submitted to council plans for a sanitary sewerage system, of which this city is much in need. The plans provide for a pumping station at the foot of S. 4th st. and Jordan creek as a site for the disposal plant.

CONTRACTS TO BE LET.

Moberly, Mo.—Bids are asked until April 6 for constructing a pipe sewer. J. F. Surry, cy. clk.

Anna, Ill.—Bids are asked until May 1 for constructing sanitary sewers. J. L. Hammond, cy. clk.

Holdrege, Neb.—Bids are asked until April 3 for constructing a complete sanitary sewerage system.

Maxton, N. C.—Bids are asked until April 4 for constructing a sewerage system. R. M. Williams, mayor.

Huron, S. D.—Bids are asked until April 10 for constructing 2 main lines of sewer. Neil McKay, mayor.

Wichita, Kas.—Sealed bids are asked until April 6 for constructing a sanitary sewer in Dist. No. 9. R. N. Dorr, cy. clk.

Frankfort, Ind.—Bids are asked until April 11 for constructing the Colfax ditch. Wm. A. Robison, drainage comr.

Salt Lake City, Utah.—Sealed bids are asked until April 3 for constructing pipe sewers in sewer exten. No. 194. Louis C. Kelsey, cy. engr.

Le Mars, Ia.—Sealed bids are asked until April 7 for constructing 1,572-ft. of 8-in. sewer, 1 flush tank and 6 manholes. D. N. Hoffmann, cy. clk.

Danville, Ill.—Bids are asked until April 4 for constructing Salina Branch ditch, involving about 1,000,000-cu. yds. of excavation. Chas. Cottingham, engr.

Canton, Miss.—Bids are asked until April 9 for constructing a sewerage system comprising 7-mis. of 6 to 18-in. pipe sewers. Walter G. Kirkpatrick, cons. engr., Jackson, Miss.

Grand Rapids, Mich.—Sealed bids are asked until April 9 for constructing a sewer in S. Front st., including embankments, gates, pump connections, etc. Chas. M. Wilson, prest. B. P. W.

Harlan, Ia.—Bids are asked until April 3 for constructing sanitary sewers, requiring 11,815-lin. ft. 8-in. sewer, 16 manholes, 13 lampholes and 8 combined flush tanks and manholes. Peter I. Peterson, cy. engr.

Moberly, Mo.—Bids are asked until April 6 for constructing pipe sewers. J. F. Curry, cy. clk.

Ft. Slocum, N. Y.—Bids are asked until April 15 for constructing a sewer system. Constr. Q. M.

Wapella, Ia.—Bids are asked until 7:30 p. m., April 2, for constructing sewers in Dist. No. 1. Cy. recdr.

Alamosa, Colo.—Bids are asked until April 15 for constructing a sanitary sewer.

Oshkosh, Wis.—Bids are asked until April 18 for constructing a sewer in 9th st. W. A. Marden, comr. pub. wks.

Lawrence, Kas.—Bids are asked until April 6 for constructing a main sewer in Bews ave. and a lateral sewer in block 56. F. D. Brooks, cy. clk.

Ft. D. A. Russell, Wyo.—Bids are asked until April 18 for extending sewer and water systems. About 7,000-ft. each of sewer and water pipe will be required. Capt. V. K. Hart, constr. Q. M.

St. Louis, Mo.—Bids are asked until April 3 for constructing Glaise creek sewer, involving 3,204-ft. of reinforced concrete sewer in open cut and tunnel and 862-ft. of 12 to 24-in. pipe sewer. H. R. Fardwell, secy. B. P. I.

Grand Rapids, Mich.—Sealed bids are asked until April 9 for constructing 4,800-ft. of 8-ft. reinforced concrete sewer, with bulkhead, pumping stations, foundations and sluice gates. L. W. Anderson, cy. engr.

Springfield, Mo.—Bids are asked until April 7 for constructing 1,474-ft. of 8-in. sewers in Dist. 12, Section 4. H. G. Horton, cy. engr.

Huron, S. D.—Bids are asked until April 10 for constructing 2 main lines of sewer. M. Schoenert, cy. clk.

Fargo, N. D.—Bids are asked until April 6 for constructing a 12-in. lateral sewer in 4th st. N. C. Morgan, cy. audt.

Rutherford, N. J.—Sealed bids are asked until 8 p. m., April 3, for constructing a lateral sewer in Gouverneur ave. F. A. Stedman, boro clk.

Le Moure, N. D.—Bids are asked until April 7 for furnishing corrugated galvanized metal culverts. E. W. Field, co. audt.

CONTRACTS AWARDED.

Tecumseh, Mich.—The contract for constructing a sewerage system was awarded to Prosser & Wonn.

Washington, D. C.—The contract for constructing a sewer in the valleys of the Broad and Soapstone branches was awarded to E. G. Gummer, for $7,018.

Evart, Mich.—The contract for constructing a sewer was awarded to John Vandermeule, of Grand Rapids.

Spokane, Wash.—The contract for constructing a sewer in an alley was awarded to Foster & Gardin, for $2,598.

Everett, Wash.—The contract for constructing a sewer in an alley was awarded to A. Thorsvig, for $1,465.

Lake Mills, Wis.—The contract for constructing 771-ft. of 8-in. and 1,229-ft. of 6-in. vitrified pipe sewers, 6 manholes and 1 lamphole in sewerage dist. No. 2 was awarded to F. E. Kominski, of Berlin, Wis.

Gary, Ind.—The contract for building sewers was awarded to J. H. Green & Sons, of Appleton, Wis., for $235,000.

Centralia, Wash.—The contract for constructing sewers was awarded to Davis & Miller, of Tacoma, for about $5,000.

San Francisco, Cal.—The contract for constructing a sewer in Folson st. was awarded to Mahoney Bros., as follows: For constructing 8-in. vitrified salt glazed ironstone pipe sewer, $1.90 per lin. ft.; brick manhole with cast-iron cover and galvanized wrought-iron steps, $90 each; furnishing and setting Y branches on 8-in. vitrified salt glazed ironstone pipe sewer, $1.50 each extra.

Petaluma, Cal.—H. Le Cam was awarded the contract for constructing 1,150-ft. of 15-in. sewer in Western ave., as follows: For 8-in. pipe, 74 cts. per lin. ft.; 16-in. pipe, $1.38 per lin. ft.; manholes, complete, $53 each; catchbasins and connections, complete, $41.50 each.

Bloomington, Ill.—The contract for building 1,200-ft. of 15-in. pipe sewer was awarded to D. H. Rider, for $1,390.03.

Newcastle, O.—The contract for constructing the 5th ward sewer was awarded to Patrick Joyce, of Youngstown, for $14,206.

Evansville, Ind.—The Zeller-Hughes Plumbing Co. was awarded the contract for constructing a sewer in 2nd ave., for $1,680.40.

Joliet, Ill.—The contract for constructing a sewer in the 1st ward was awarded to the Ross & Curtis Stone Co., for $26,-792.60.

Argentine, Ark.—The contract for constructing sewers was awarded, Mar. 10, to L. L. Maxson, 822 Powell ave., for $3,780.

St. Paul, Minn.—The contract for building a sewer in Park ave. and Lytton Place was awarded to Christ Johnson, for $3,-521.

Gloucester, N. J.—Edward J. O'Hara, of this city, was awarded the contract for constructing a terra cotta sewer, for $4,-660.

Oakland, Cal.—The contract for building a storm sewer in Grand ave. was awarded to the Stanley Construction Co., for $10,000.

Norwalk, O.—The contract for constructing 1½-mis. of pipe sewers was awarded to Penny & Corron, of Lorain, Mar. 6, for $27,000.

Santa Monica, Cal.—The contract for constructing a septic sewer tank was awarded to the California Ornamental Brick Co., of Los Angeles, for $4,847.

Wichita, Kas.—The contract for constructing sanitary sewers was awarded, Mar. 2, to the Municipal Constr. Co., of Kansas City, Mo., for $75,401.

Newark, N. J.—The contracts for construction work on the Warwick st. and section 2 of the Meadow Brook sewer

system were awarded to D'Ameter & Stefanelli and James A. Christie.

Baltimore, Md.—The Metropolitan Construction Co., of Boston, was awarded the contract for constructing the west low-level intercepter sewer, for $150,895.15.

Louisville, Ky.—The contract for constructing 4,000-ft. of sewer, one-half of which is a tunnel, was awarded to the E. G. Nave Bros. & Co., of Portsmouth, O., for $100,000.

Steubenville, O.—The contract for constructing a sewer in McLister ave. was awarded to Charles F. Neville, at $8 per ft. for 6-ft. sewer, $35 for catchbasins and $40 for manholes.

Mingo Junction, O.—The Carnegie Steel Co., of this city, was awarded the contract for constructing a concrete sewer at $12 a lin. ft. for 6-ft. concrete or reinforced sewer, $9 for 8-ft. sewer, $70 for brick catchbasins, $65 for brick manholes, $85 for 8-ft. and 6-ft. sewers.

Auburn, N. Y.—The contract for constructing sewers in the 4th, 5th, 6th and 7th wards was awarded, Mar. 17, to Thomas Viscount, 868 Flora st., Elizabeth, N. J., for $81,488. The contract for constructing the sewage disposal plant was awarded to the Beckwith Co., of Herkimer, N. Y., for $41,445.

WATER WORKS.

Middletown, Del.—The Belle Ayr Water Co. has been incorporated by J. Glenworth Butler and Wm. H. Cammeyer, of Boonton, N. J., and Eugene E. Howe, of Fleischmanns, N. Y.

CONTEMPLATED WORK.

Spencer, Ind.—A water-works system is contemplated.

Heuvelton, N. Y.—A water-works system is contemplated.

Cleveland, O.—The extension of the water mains is proposed.

Mountain Home, Idaho.—A water-works system is contemplated.

South Bend, Ind.—The extension of the water mains is proposed.

Newport, N. H.—Voted to issue bonds for a water-works system.

Henryetta, Okla.—Plans for a water-works plant are being prepared.

De Forest, Wis.—Voted to issue bonds to install a water-works system.

Utica, Minn.—The question of constructing water-works is being agitated.

Minneapolis, Minn.—About 10-mis. of water mains extensions are contemplated.

Riverton, Wash.—A company has been organized to supply this city with water.

Newton Falls, O.—This town voted to issue bonds for constructing water-works.

Portage La Prairie, Man.—City council has decided to install a water-works system.

Wilson Creek, Wash.—Surveys for establishing a water-works system are being made.

Evanston, Ill.—The city council voted to expend $80,000 for water-works improvements.

Kirwin, Kas.—Council is considering the question of constructing a water-works plant.

Dresden, O.—Will vote April 4 on the issue of bonds for constructing water-works.

Ventnor City, N. J.—This city contemplates the purchase of the Ventnor City Water Co.

Hooksett, N. H.—This town voted to install a water-works system. John C. Dutton, town clk.

East Brookfield, Mass.—This city may vote on the issue of bonds for constructing water-works.

Brooklyn, N. Y.—Plans for repairing the Millburn reservoir, in Nassau county, are being prepared.

Dickson, Tenn.—This city may vote on the issue of bonds for constructing a water-works system.

Athens, Ga.—Will vote April 15 on the issue of bonds for the extension of the water-works system.

Pleasant Hill, O.—The citizens voted to issue $25,000 bonds for constructing a water-works system.

Sidney, Neb.—A resolution has been adopted providing for the issue of bonds. L. Neubauer, vil. clk.

Birmingham, Ala.—The question of issuing $500,000 bonds to secure municipal water-works will be voted on.

Ogden, Utah.—This city proposes to purchase the present water-works plant or build a new one.

Brunswick, Md.—A bill has been passed authorizing the issue of bonds for constructing a water-works system.

Evansville, Ind.—Plans for a mechanical filtration paint have been submitted to the board of water-works trustees.

Abilene, Kas.—This city contemplates constructing 2,000-ft. of 4-in. water mains extensions. J. A. Graves, cy. clk.

Birmingham, Ala.—North Birmingham will vote April 20 on the issue of $5,000,000 bonds to build a water-works system.

Yuba City, Cal.—A petition is being circulated asking that this town be bonded for the purchase of Yuba City Water-works.

Wichita, Kas.—This city will vote in April on the question of acquiring the present water-works system or building a new one.

Hereford, Tex.—This city will vote April 7 on the issue of $20,000 bonds for the purpose of constructing water-works and sewerage systems.

Madison, Ind.—The bd. of trustees of Hanover College has authorized the installation of a general water system in the college buildings and grounds.

Concordia, Kas.—Special.—The city council has passed an ordinance submitting a proposition to vote $42,000 bonds at the April election for the extension and improvement of the water-works system. E. A. D. Parker, cy. engr.

Lake Village, Ark.—Special.—Herman Carlton, secy. impvt. dist. No. 4, says council has appropriated $35,000 for the purpose of digging an 8-in. artesian well and bids will be asked as soon as the board of improvements can get specifications from the engineer. An issue of $30,000 6 per cent. water-works and electric light bonds, payable in 10 yrs., with option of 20 yrs., has been authorized, and as soon as these bonds have been sold the contract will be let.

CONTRACTS TO BE LET.

Ft. Dade, Fla.—Bids are asked until April 16 for constructing 6 surface wells. Constr. Q. M.

Maxton, N. C.—Bids are asked until April 14 for installing a water-works system. R. M. Williams, mayor.

Rushford, Minn.—Bids are asked until April 8 for the extension of the water-works system. C. O. Alm, cy. clk.

Kansas City, Mo.—Sealed bids are asked until April 10 for constructing an intake pier at Quindaro. E. A. Harper, cy. engr.

Holyoke, Mass.—Bids are asked until Apirl 10 for c. i. pipe and special castings. Oscar C. Ferry, asst. clk. B. P. W.

White Plains, N. Y.—Bids are asked

until April 17 for installing a pumping engine on the foundation in the pumping station. John Heeney, supt. water comrs.

Staatsburgh, N. Y.—Bids are asked until April 4 for constructing a water-works plant for the Staatsburgh Water Co. Harry C. Barker, atty., 54 Market st., Poughkeepsie, N. Y.

Malta, O.—Sealed bids are asked until April 28 for the construction of a pipe system for water-works. Frank C. Mills, prest. B. P. A.; Paul R. Murray, cons. engr., New Philadelphia, O.

Council Bluffs, Ia.—Sealed bids are asked until May 18 for furnishing a power plant complete, settling reservoirs, distribution system, high service reservoir. W. F. Sapp, cy. clk.

Washington, D. C.—Sealed bids are asked until April 15 for constructing Clear Lake dam and dikes, located about 55 mis. southeast from Klamath Falls, Klamath Project, Oregon-California. Jas. R. Garfield, Secy. Interior.

Oswego, N. Y.—Bids are asked until April 7 for furnishing c. i. pipe and special castings for constructing an intake crib and a c. i. intake pipe 30-in. in diameter, in Lake Ontario, for the municipal pumping plant; until April 8 for constructing the intake; until April 14 for laying c. i. pipe and specials for the lake water extension. F. W. Ormsby, secy. water dept.

CONTRACTS AWARDED.

Milwaukee, Wis.—The contract for laying water mains during 1908 was awarded to R. J. Hickey.

Muscatine, Ia.—The contract for laying water mains was awarded to the Dimmick Pipe Co., for $10,000.

Big Stone Gap, Va.—The contract for the completion of the reservoir was awarded to W. W. Taylor, for $5,000.

Los Angeles, Cal.—The contract for furnishing 1,000 trident ⅝-in. water meters was awarded to the Neptune Meter Co., for $8,400.

Ashland, Ore.—The contract for furnishing c. i. pipe for the new city distributing system was awarded to the Crane Co. at $52 per ton.

Marion, Mass.—The contract for constructing a pumping station and shed was awarded to Augustus A. Cobb, of this city, for $3,229.

Atlanta, Ga.—The contract for furnishing a pump for the pumping station was awarded to the Wisconsin Engine Co., of Corliss, Wis., for $137,000.

Herington, Kas.—The contract for constructing a water and light plant was awarded to the Squire Electric Co., of Kansas City, Kas., for $40,000.

Newburyport, Mass.—The contract for furnishing 10 and 12-in. pipe was awarded to Charles Miller & Sons Co., of Utica, N. Y., for about $10,500.

Cheyenne, Wyo.—The Ambursen Hydraulic Construction Co. has been awarded the contract for constructing the La Prele creek reservoir, for $255,000.

Rochester, N. Y.—The contract for furnishing c. i. pipe and special castings was awarded to the Warren Foundry and Machine Co., of Utica, for $55,340.

American Falls, Idaho.—The contract for constructing a reservoir and waterworks was awarded to the Wheelwright Construction Co., of Ogden, for $4,580.

Colusa, Cal.—The contract for completing the 1½-mis. of the 4-mile canal or irrigation ditch of the Colusa Irrigation Co. was awarded to J. R. Tennant.

Park Ridge, N. J.—The contract for rebuilding the dike well, reinforcing and raising the height of the dam, building a concrete spillway, etc., was awarded to George C. Bennett, of this city, for $10,000.

Duluth, Minn.—The contract for extending the water and sewer systems was awarded to Wm. Vuoti, of Ely, for $9,831; furnishing water pipe, Marshall-Wells Co., of Duluth, $28.25 per ton; valves, Northwestern Foundry, Minneapolis.

Mendham, N. J.—Bids were submitted Mar. 21 for constructing a water-works system, but action on them was deferred. The bids were as follows: F. S. Smith, $15,143.50; J. C. Tierney, $15,227.90; Geo. B. Byram, $15,949.90; Fitz & Partridge, $16,475.50.

BRIDGES.

Cheboygan, Mich.—City council has petitioned for a bridge across the river at Pine st.

Yankton, S. D.—Bids are asked until April 7 for building bridges. David M. Finnegan, co. audt.

Silt, Colo.—Bids are asked until April 3 for building a bridge. T. W. Jaycox, state engr., Denver.

Youngstown, O.—Plans for an overhead bridge at Spring Common have been prepared. F. M. Lillie, cy. engr.

Brookings, S. D.—Bids are asked until April 8 for constructing a cement bridge. P. J. Murphy, co. audt.

Santa Rosa, N. Mex.—Bids are asked until April 6 for building a bridge across Pecos river. Co. comrs.

Watertown, S. D.—Bids are asked until April 8 for constructing a steel bridge. E. I. Lamby, co. audt.

Valparaiso, Ind.—Bids are asked until April 7 for constructing various bridges. Stephen P. Corboy, co. audt.

La Moure, N. D.—Bids are asked until April 7 for constructing wood or steel bridges. E. W. Field, co. audt.

Ft. Meade, S. D.—Bids are asked until April 10 for constructing bridges and culverts. Capt. L. C. Scherer, Q. M.

Auburn, Cal.—Bids are asked until April 6 for constructing a concrete and steel bridge across Bear river. Placer co. supvrs.

Rome, Ga.—The question of replacing all the steel bridges around this city with concrete is being considered.

Cathlamet, Wash.—Bids are asked until April 6 for constructing a wooden drawbridge over Deep river. Co. comrs.

Chehalis, Wash.—Bids are asked until April 7 for constructing a steel bridge on concrete. Ernest C. Bechly, co. engr.

Crawfordsville, Ind.—Bids are asked until April 7 for building 3 bridges and repairing several others. B. B. Engle, co. audt.

Birmingham, Ala.—Bids are asked until April 8 for constructing 8 steel or reinforced highway bridges. P. S. Milner, co. engr.

Middletown, O.—Bids are asked until April 7 for building a new hoist bridge of steel and concrete, over Canal, at Tytus ave. Co. comrs.

Copperhill, Tenn.—Bids are asked until April 3 for building 3 steel highway bridges over different streams. B. H. Case, engr. in charge.

Scranton, Miss.—Bids are asked until April 6 for building a steel bridge over Dog river and Cooper's Mill creek. I. P. Delmas, clk. bd. supvrs.

Vancouver, B. C.—Bids are asked until April 4 for the manufacture and erection of 2 new bridges over False creek, Weston ave., Granville st., etc.

Wichita, Kas.—Bids are asked until April 6 for constructing 5 pile bridges, 2 steel bridges and 1 steel or concrete bridge. C. N. Cartwright, co. audt.

Salem, N. J.—Bids are asked until April 4 for constructing an additional length to a drawbridge and moving back the fixed span. Wm. W. Carter, engr., Woodbury.

Zanesville, O.—Bids are asked until April 20 for erecting the substructure of a highway bridge over Salt creek, in Salt Creek twp. L. E. Breisford, co. audt.

St. Paul, Minn.—Bids are asked until April 6 for constructing a steel or concrete bridge across Mississippi river boulevard. Geo. T. Redington, secy. bd. park comrs.

Nebraska City, Neb.—Bids are asked until April 7 for constructing a steel bridge on steel tubes or reinforced concrete, and I-beam bridge. A. P. Young, co. clk.

Milwaukee, Wis.—The contract for erecting a bascule bridge across the Kinnickinnic river, at Kinnickinnic ave., was awarded to Arthur H. Vigel, of the Starke Dredge & Dock Co., for $119,842.

Akron, O.—Sealed bids are asked until April 7 for constructing a concrete substructure on piling foundation, with steel superstructure, over the Ohio canal, at Kenmore, near here. Mark D. Buckman, co. audt.

Newark, N. J.—Sealed bids are asked until April 2 for the repair and alteration of the aprons of a drawbridge across the Passaic river, at Nutley. G. F. Drum, co. engr. of Essex; R. D. Earle, co. engr. of Bergen.

Cincinnati, O.—Sealed bids are asked until April 7 for constructing piers, abutments and retaining walls for the substructure of the viaduct for the Terminal Track, from 8th st. to McLean ave. John R. Sayer, prest. bd. trustees Cincinnati Southern Ry.

STREET LIGHTING.

Houma, La.—An electric light plant is contemplated.

Trenton, Mo.—A municipal electric light plant is contemplated.

Hartford, Wis.—The establishment of a municipal electric light plant is contemplated.

West Milton, O.—The construction of a hydro-electric light plant is contemplated here by L. A. Pearson.

Edinburg, Va.—Bids are asked until April 11 for an electric light franchise. J. D. Lennon, mayor.

Lecompte, La.—Bids are asked until April 7 for building an electric light plant. W. H. Jones, cy. clk.

Chilton, Wis.—This city will vote on the question of municipal ownership of an electric light plant.

Cedarville, O.—The question of installing an electric light plant is under consideration by the city council.

Glasgow, Mont.—This city contemplates the construction of an electric light plant. H. C. Allen, cy. engr.

Springfield, Mass.—The contract for underground conduits has been awarded to Fred T. Ley & Co., 307 Main st.

Lafayette, Ga.—Bids are asked until May 1 for constructing an electric light plant. J. A. Clements, cy. recdr.

Chicago, Ill.—Bids are asked until April 2 for furnishing this city gasoline lights in certain streets. Wm. Carroll, cy. elect.

Slocomb, Ala.—Plans are being considered for constructing an electric light plant here. A. C. Kelley is interested.

Cleveland, O.—City council has appropriated $35,000 to purchase machinery for the municipal electric light plant in South Brooklyn.

Topeka, Kas.—This city will vote on the issue of bonds for constructing an electric light addition to the city. John P. Rodgers, cy. engr.

Ft. Worth, Tex.—Bids are asked until April 7 for lighting the streets and furnishing a generator with exciter, switchboard panel, etc. J. J. Nunnelly, cy. arch.

New Bedford, Mass.—City council has appointed a committee to investigate the question of municipal lighting. W. H. Remington, clk. com., Rm. 8, Library Bldg.

Moose Jaw, Sask.—Bids are asked until April 6 for work in connection with the extension of the municipal electric light plant. John D. Simpson, secy.-treas.

New York City.—Bids are asked until April 6 for furnishing and setting lighting fixtures in pavilions A and B of the new Bellevue Hospital, 1st ave. to East river and 26th and 29th sts., Manhattan boro. John W. Brannan, prest. bd. trustees Bellevue and Allied Hospitals. Bids are asked until April 6 for installing electrical equipment in public school No. 16. C. B. J. Snyder, supt. school bldgs.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

Caraopolis, Pa.—Bids are asked until April 6 for the removal of garbage for 1 yr. E. C. Harper, boro clk.

Knoxville, Tenn.—The contract for sprinkling the streets was awarded to the Knoxville Street Cleaning and Sprinkling Co.

Malden, Mass.—The contract for the disposal of house offal for a period of 3 yrs. was awarded to Levi Elms, Forest st., Melrose, at $1,800 per year.

Columbus, O.—Bids are asked until May 11 for constructing a garbage reduction plant. John H. Gregory, engr. in ch.

Pittsburg, Pa.—The contract for collecting and disposing of the city's garbage for 1 yr. was awarded to the American Reduction Co., 1516 2nd ave., for $186,000.

PARKS.

Rochester, Minn.—The park bd. contemplates establishing a new park.

Brockton, Mass.—George E. Keith has offered a tract of 35 acres to this city for park purposes.

Canton, O.—This city is taking by condemnation proceedings a tract of 11 acres at Linden ave. and Lake st., for park purposes.

Independence, Mo.—The Commercial Club voted to invite George E. Kessler, of Kansas City, to investigate the possibilities of a park and boulevard system here.

FIRE APPARATUS.

New York City.—Bids are asked until April 3 for furnishing and delivering 20,000 ft. of fire hose. Nicholas Hayes, fire comr.